دليل اجراءات الايصال للمشترك الجديد

New connection manual

اعتماد

رئيس قطاع خدمات التوزيع بالنيابة	م. بندر سالم الحربي	التوقيع:

الشركة السعودية للكهرباء
Saudi Electricity Company
طاقة مثمرة

NEW CONNECTION MANUAL

Saudi Electricity Company – Distribution

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1. INTRODUCTION

The New Connection Manual (NCM) serves as a compilation of SEC procedures and guidelines related to the new connection process aimed at increasing applicability of these documents. The content taken from related documents to from this manual has been updated to current SEC practices as well as to the outcomes of the 'New Connection Process Streamlining' imitative under the Distribution Excellence project. It draws on main parts of procedures and guidelines that were written for specific procedures or tasks related to network planning and construction of new connections. Besides increasing applicability of procedure and guideline document the intent of this version is to simply, streamline, clarify, and remove duplication and redundancy found in previous manuals. The New Connection Manual should be established as the single source of reference for any SEC Distribution activities related to the new connection process.

1.1. HOW TO USE THE NEW CONNECTION MANUAL

Information in this manual is presented in a top-down approach along the major steps of the new connection process; a high-level description of major tasks are presented as an introduction and quick reference, followed by detailed procedures and guidelines. The appendix provides a compilation of the most recent versions of main documents and forms related to the new connection process. Figure 1illustrates the main process steps of the new connection process and outlines the structure of the New Connection Manual.

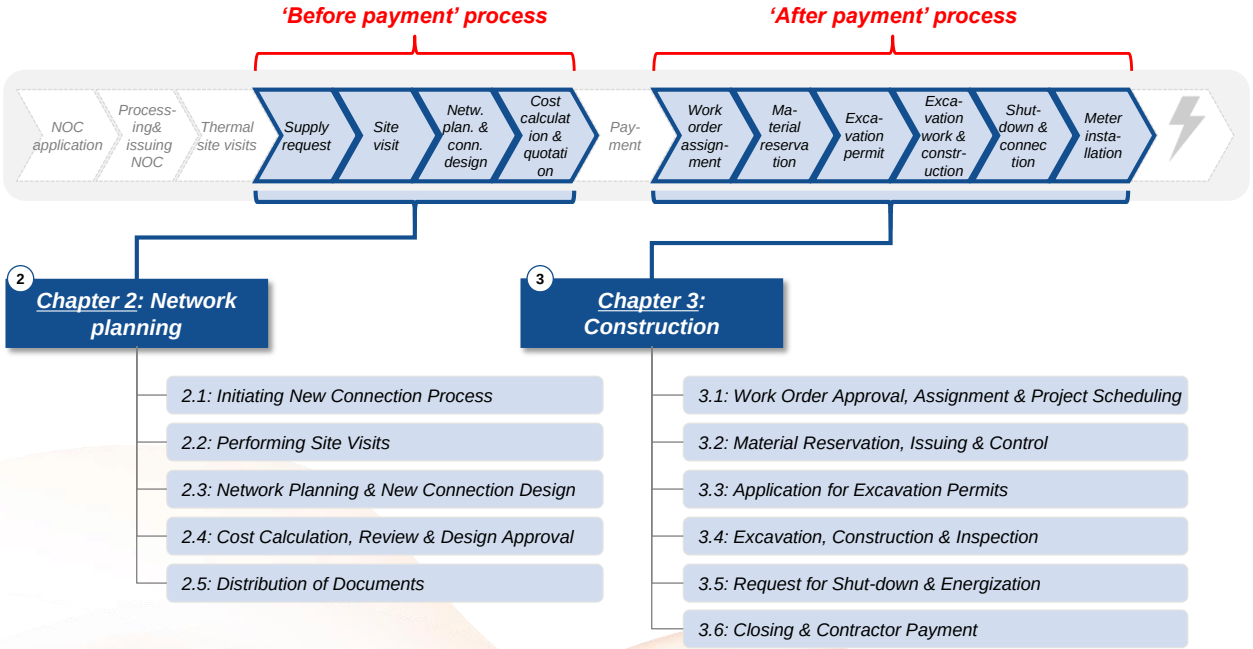


Figure 1: Overview structure New Connection Manual (NCM)

Following this introduction and general safety message, section two focuses on procedures related to the 'before payment' part of the new connection process. Specifically it outlines main tasks related to: (2.1) the initiation of the new connection process, (2.2) performing site visits, (2.3) network planning and connection design, (2.4) cost calculation, review and design approval and (2.5) the distribution of documents. Section 4.1in the Appendix then provides the main documents and forms related to the 'before payment' part of the process.

Section three the outlines the main procedures related to the 'after payment' part of the new connection process. Specifically it outlines main tasks related to: (3.1) Work order approval, assignment & project scheduling, (3.2) material reservation, issuing & control, (3.3) application for excavation permits, (3.4) excavation, construction & inspection, (3.5) Request for shut-down and energization and (3.6) the closing and contractor payment. Section 4.2 4.2in the Appendix then provides the main documents and forms related to the 'after payment' part of the process.

If viewing on an electronic device, the document has hyperlinks the reader can click on that will link immediately to other referenced sections of the report, including on-line resources if connected to the internet.

1.2. SAFETY

It is important that SEC staff carries out work with appropriate care, attention and adherence to correct practice and procedures to protect life and property.

Supervisors should ensure that their staffs are equipped with the proper safety equipment, wear appropriate/recommended personal protective gear for the job and that the staff shall be aware of their correct use. Every employee, contractor or any agent acting on behalf of SEC is responsible for their own safety, and it is their responsibility to be aware of and to adhere to all safety guidelines and practices. Any questions should be directed to the supervisor or department safety coordinator.

A few general guidelines in this regard are given below:

- Obtain all necessary permits and clearances before commencement of work
- Only authorized people should work on electrical lines and equipment
- Do not work on live (energized) circuits or equipment
- Follow all safety and work permit rules strictly
- All safety gear and equipment must be used according to Distribution Safety Manual. Please refer to on-line reference at http://sec2/dist_cust/dist/DistStandard/DSM/index.htm
- Use only tools in good working condition, and do not use a general tool if a special tool is specified for a task
- Ground all electrical equipment before working on it, including overhead lines

- Always use approved parts and lubricants only
- To prevent personal injury, person performing inspection by thermal camera must know that reflective objects result in lower than actual temperature measurements and these objects pose a hazard

1.3. REFERENCES

In general, when performing activities related to the new connection process kindly refer to below documents in addition to the New Connection Manual where necessary. More detailed references can be found in the introductory section of each chapter.

- Distribution Planning Standards (DPS)
- SEC Distribution Construction Standard (SDCS)
- SEC Customer Service Manual
- SEC UDS Manual
- Standard for Electric Utility Workplace Electrical Safety for Generation, Transmission and Distribution IEEE/ANSI
- NESC – National Electrical Safety Code
- SEC 5 Star

2. BEFORE PAYMENT PROCESS – NETWORK PLANNING

This chapter focuses on procedures and guidelines related to the 'before payment' part of the new connection process, i.e. the network planning related activities. In detail the below process steps are targeted by the subsequent chapters as outlined in Figure 2.

- Initiation of the new connection process
- Performing site visits
- Network planning and connection design
- Cost calculation, review and design approval
- Distribution of documents

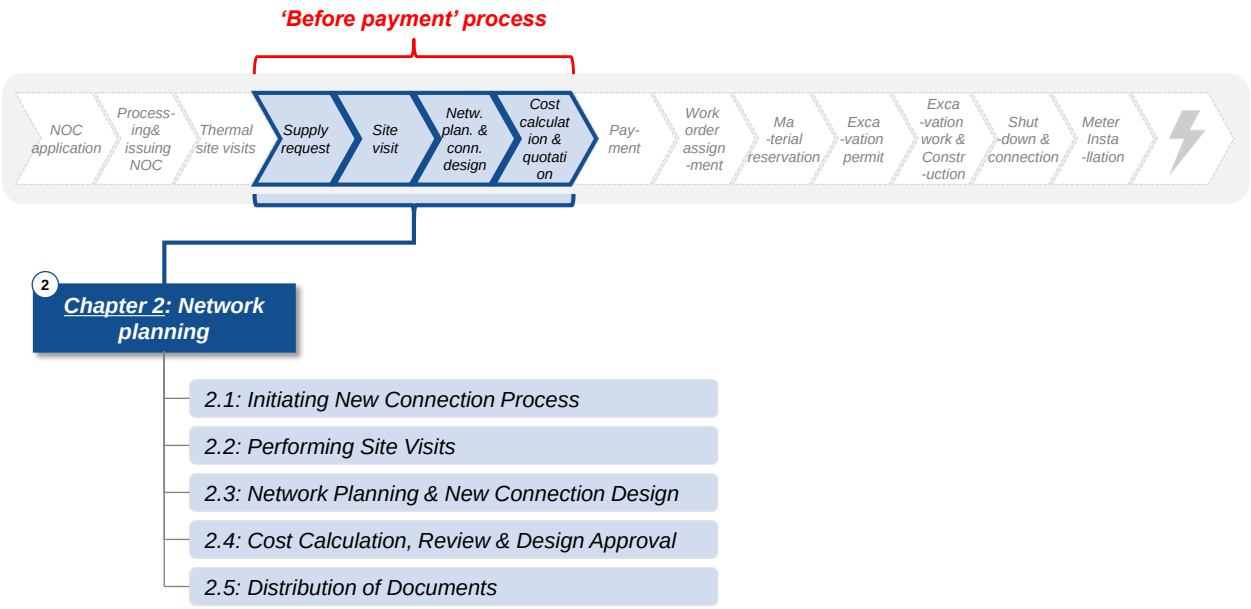


Figure 2: Overview 'before payment' process

The content for this section is based on the below outlined documents and has been updated and validated in accordance with the outcomes of the 'Distribution Excellence – New connection process streamlining' initiative. Documents include:

- Distribution Planning Standards (DPS)
  - DPS-01: Distribution Planning Standards Estimation of Customer Load Guideline (Connected Load & Demand Load)

- DPS-02: Distribution Planning Standards Design Guideline of Underground Low Voltage Network To Supply Customers
- DPS-03: Distribution Planning Standards Design Guideline of Overhead Line Low Voltage Network To Supply Customers

2.1. INITIATING NEW CONNECTION PROCESS

The SEC Board of Directors annually approves a total expenditure level for distribution capital projects and related work for the following budget year. This forms a SEC funded Budget Item (BI), which is included as part of the company's approved capital program. A second BI covers expenditures on distribution capital work which are totally customer funded.

All distribution capital Projects are approved within these budget items except for specified system improvement projects associated with grid station reinforcement.

Distribution projects must be designed by network planning departments according to SEC standards so that they can be executed by the respective construction units. They must also be costed and approved individually according to SEC corporate approval authority.

Several types of requests are considered when handling connection matters such as:

- Request for new connection
- Request for increasing number of meters
- Request for increasing capacity
- Request for decreasing capacity
- Request for splitting capacity
- Request for combining loads
- Request for direct connections of small loads without meters
- Request for new connection of bill boards, communication towers and other loads
- Request for new connection of SEC facilities
- Request for changing voltages
- Request for changing meters having the same capacity

This section focuses on handling requests for new connections from a detailed procedures perspective.

2.1.1. INTRODUCTION TO INITIATING NEW CONNECTION PROCESS

As per criteria specified in the SEC Customer Service Manual the customer is required to submit all relevant documentation to SEC customer relations unit (CRU) in order to trigger the new connection process.

2.1.1.1. PROJECT SOURCING

It is important to ensure that new connection requests are initiated in sufficient time to enable the new or revised network arrangement to be energized when needed. Also, it is crucial for the network planning responsible to determine if projects are SEC or customer funded in order to be able to start the process accordingly.

SEC Funded

The main sources of SEC Funded Projects are

- Extension of network in Plot Plans in anticipation of customer applications for supply to dwellings under construction.
- New or increased power supplies to other customers in planned areas which involve extension or alteration of the primary and/or secondary network.
- Supply to Villages/hijras as per E.D. approved plans.
- Projects required for implementing agreed network plans. This would include such work as:
    - Feeder alteration and improvement (for standard and nonstandard networks).
    - Undergrounding of overhead networks and all diversions appropriate to the Capital Account.
    - Integration of new grid stations.
    - Network standardization.

Customer funded

- New or Increased supplies to customers in unplanned areas who are not willing to wait until SEC extend its networks.
- Temporary power supplies.
- Provision of power supply involving nonstandard voltage.
- Power supply to isolated farms.
- Part of power supply to farm clusters.
- Others as per Customer Service Manual.

Determination of which supplies are to be customer funded is to be decided in accordance with guidelines issued by customer relations department. The customer service manual may be consulted for appropriate guidelines.

2.1.1.2. PROJECT SCOPING

In order to determine the scope of a new connection request and thus responsibilities within the network planning phase it is important to differentiate between standard new connection requests and projects.

Standard New Connection Requests

- All primary and secondary network extension and/or alterations
- Service cables for all houses under construction which are located within the proposed network zone
    - The proposed meter position(s) must be established in such cases. The meter(s) will not be included in the project, except in customer funded cases
- When a project includes service cables from mini-pillars/poles to the customer's premises, the project is to be cross-referenced to the relevant customer application/file numbers, which are to be entered in the Design Checklist/Transmittal form

New Connection Projects

A small number of large Projects may need to be subdivided to facilitate execution by construction unit. The following procedure is to be followed for this type of situation

- If a project will involve a large amount of cable, the NP superintendent will decide if the project needs to be subdivided.
    - A decision to subdivide will be based primarily on the need to allocate the project to separate contractors to ensure either that the total job can be completed over a reasonable timescale or to facilitate more even allocation of work to Contractors
- If a decision is made to subdivide the project, a separate project is to be prepared for each part of the overall job. These separate projects must be associated with each other at, all times during the design and approval phases
- A single Design Number is to be used for all associated projects
- The same Project Layout Drawing and Single Line Diagram are to be used, if possible, for all of the associated Projects. The extent of each Project must be clearly indicated on the drawing/diagram.
- A separate scope of work is to be prepared for each Project with overhead network
- A separate cost estimate is to be prepared for each Project (Exhibit 5),
- When prepared, the complete set of projects must be associated together and forwarded for approval at the same time. Separate project numbers are to be assigned to each of the associated projects.

- Each project is to be separately approved but the combined estimated cost of the associated projects must be taken as the amount for determining the authority level required for approval.

2.1.2. General Procedure For New Connection Process Initiation

After projects have been sourced (whether from customer applications, system improvement requirements or otherwise) they are to be formally initiated by the superintendent/ senior engineer.

The creation of a new permanent connection to the grid for all facilities meeting the health and safety requirements (and not built of wood, straw or flammable materials) happens in three phases:

2.1.2.1. Phase One: No-Objection Certificate (NOC)

It is a certificate requested from SEC and obtained by the applicant before issuing a building permit, indicating the possibility of delivering electricity to the targeted location and highlighting the maximum allowed capacity for the building, the number of units and breaker capacities

The following actions are required:

- Review all information in the form and check compliance to requirements
- Study the load requested by the applicant and determine the requirements according to the following:
    - Location and description of required meters
    - Location of sub-station
    - Energization possibility for sites outside of the network range
- Open a new request in the UDS
- Issue the NOC for the applicant after completion of the requirements (including the validation date), as well as a sheet highlighting the recommended size of cables, and installation routes.
- The specifications of new connection type include:
    - Connection of meters w/o excavation
    - Connection of meters with LV excavation
    - Connection of meters with substation
    - Connection of meters with overhead lines

- Feeding small load unit w/o meter
- Temporary connection (for events purposes)
- Farm electrification w/o meter
- Farm electrification with meters
- Compounds projects
- Connection of government buildings
- Replacement of distribution networks
- Cadastral survey
- Remove / shift of a network by customer funding
- Applications without title deeds

For details regarding the opening of new connections request in UDS kindly refer to the 'UDS manual' document available on SEC's intranet.

- The reference number will automatically be allocated to the Project from UDS. The NOC number will be equivalent to the UDS number. The connection request can always be referenced by the generated number

2.1.2.2. PHASE TWO: REQUEST FOR CONNECTING TO THE GRID

After issuing the NOC, the network planner will then take the following actions:

- Perform site audit to validate the number of units highlighted in the NOC/Building certificate as well as the readiness of the site. In cases of discrepancy, the lowest number of units is considered to avoid changing the calculated installation costs. In cases of merging units to lower the installations costs, the applicant is required to modify the building certificate to remove the discrepancy.
- Record the request in the UDS if the requirements above are met for the unregistered cases
- Complete payment procedures

Once completed, SEC is responsible for building the electric network and installing the required connection and equipment to provide the electric services within a period of 30 working days from the date of payment, in case there are no obstructions from third parties.

2.1.2.3. PHASE THREE: ENERGIZING THE PERMANENT METER

The electrical services are provided for the applicant after executing the implementation plan and handing the construction completion document, combining the total consumption of the meters feeding a single unit, or commercial shops or connected offices in a single bill.

2.2. PERFORMING SITE VISIT

This procedure describes the steps to be taken before the site visit and while on site by the site surveyor.

2.2.1. INTRODUCTION TO SITE VISIT PROCEDURE

Many aspects of the work carried out on site visits are related to the judgment, experience and skill of the Network Planning engineer/ the site surveyor. This includes evaluating the proposed position of equipment, cables, ROW requirements, etc.

The procedures set out concentrate on the preparations to be made before the site visit, some on site activities and the information to be recorded as a result of the site visit.

2.2.2. SITE VISIT PROCEDURE

The detailed procedures which are to be followed when visiting or surveying the site of a proposed Project are set out as following.

2.2.2.1. BEFORE THE SITE VISIT

Before visiting the site, obtain copies of the following, if possible:

- Basic location data from GIS
- Geographic base map if GIS is not available
- Existing network drawing(s) from maps or GIS
- Development drawing(s) (*if available*)
- Plot Plan indicating master design and agreed equipment locations

Obtain load information if not available in GIS from

- Feeder load records
- Substation load records
- Customer files

Determine potential source(s) of supply from GIS/ maps if possible.

2.2.2.2. ON THE SITE VISIT

As per the current SEC strategy, at least one site visit is required. Every effort must be made to reduce the number of additional site visits. This can best be achieved by adequate preparation before the visit to site. The main tasks for the site surveyor include but are not limited to:

- Determine existing cable, line routes and equipment positions
- Determine potential source(s) of supply.
- Note the position of proposed cables in relation to geographic features including property lines, footpaths, etc.
- Determine proposed equipment locations precisely to facilitate obtaining necessary permissions to site the equipment. In addition, this is necessary for later mapping of facilities and network information. The locations are to be noted on the layout plan.
    - Guidelines on the degree of accuracy of as-built network recording are specified in the SEC standard for Distribution Mapping and Recording (SDS-11).
- Measure the proposed cable and/or line route lengths. Measurement is to be done with tape or measuring wheel. Note the measured lengths on the layout sketch.
- Check the site carefully for potential ROW problems.
- Note the positions and configuration of existing network and details of equipment which is to be retired or replaced.
- It is essential that final levels and road lines be established with the relevant authority/developer to avoid future problems concerning the placing of plant and/or cable laying depths.
- The site visit check list which can be found in section 2.2.4.1gives a more detailed outline of information to be captured during the site visit.

2.2.3. CUSTOMER REMARKS

In case the site surveyor finds obstacles that would not allow for a permanent supply connection on the customer premises, he would leave remarks. Such remarks would for example be that the construction of the house it not advanced enough or that there is construction material that would block the connection construction.

In such cases, the site surveyor has to take note of these remarks on site and needs to collect the required material to document (pictures, sketches etc.) these remarks properly. Once back in the office or onsite via FFMS handheld, the site surveyor needs to enter the remarks in the UDS system. He then also needs to decide whether those remarks can be solved via picture, i.e. the customer receives a message to upload a picture of the solved remark or if a second site visit needs to be performed.

Figure 3 outlines the customer remark process for both processes.

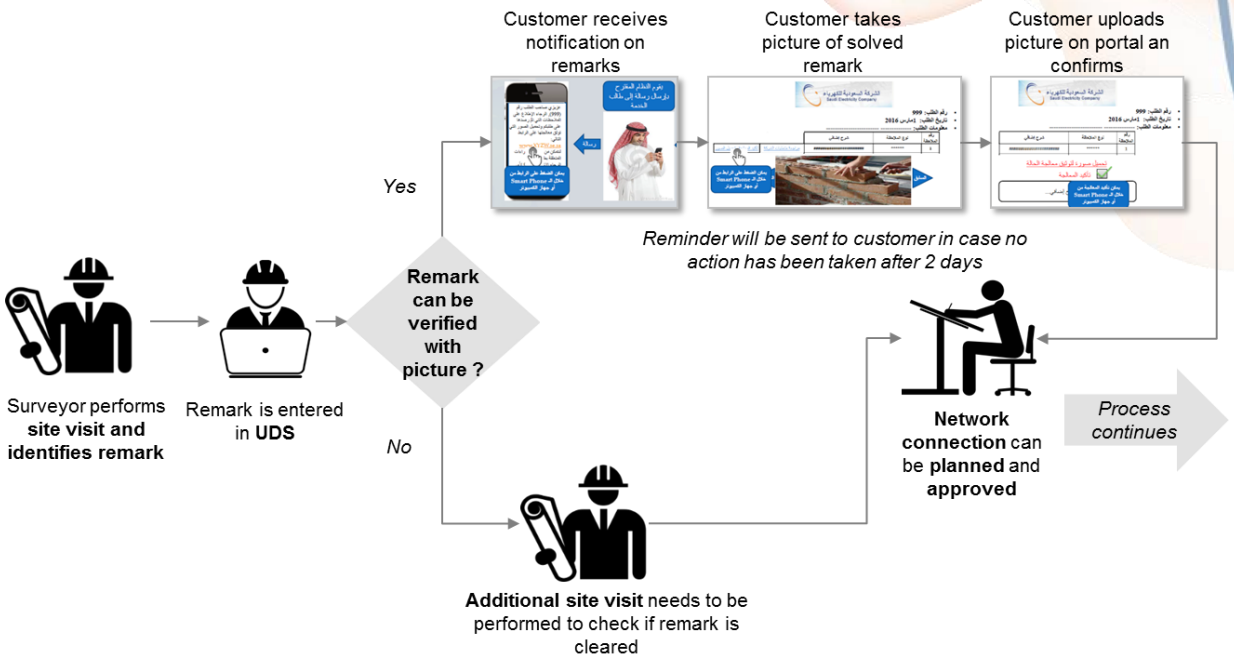

Customer receives notification on remarks
Customer takes picture of solved remark
Customer uploads picture on portal an confirms
Yes
Reminder will be sent to customer in case no action has been taken after 2 days
Surveyor performs site visit and identifies remark
Remark is entered in UDS
Remark can be verified with picture ?
No
Network connection can be planned and approved
Process continues
Additional site visit needs to be performed to check if remark is cleared

Figure 3: Customer remarks process

2.2.4. Site Visit Support Material

In this section main support documents for performing site visits can be found

2.2.4.1. Site Visit Check List

The newly developed site visit check list assures that all relevant information is captured at the first time, therewith avoiding delays and extra cost resulting from additionally performed site visits.

Figure 26 provides the most recent version of the site visit check list to be used while inspections.

2.2.4.2. Substation Check List

The substation check list provides an indication of all relevant information that needs to be captured in addition to the standard site visit check list (Figure 26) when a substation component is involved in the visit/ the design of the connection.

Figure 27 provides the most recent version of the substation check list to be used while inspections.

2.3. NETWORK PLANNING & NEW CONNECTION DESIGN

Once the site visit has been performed and all customer remarks have been resolved, the network planning section can start to produce the new connection design scheme.

2.3.1. INTRODUCTION TO NETWORK PLANNING & NEW CONNECTION DESIGN

All new connection design schemes must be in line with SEC's planning guidelines and SEC's distribution network planning standards (DPS).

2.3.1.1. PLANNING PRINCIPALS

The Low voltage networks (also called secondary network) are connected at one end and have no facility of back-feeding.

The following objectives should be achieved in the design of low voltage networks taking into account all prevailing safety and reliability standards:

- Satisfaction of Customer Coincident Demand Load:
- Equipment ratings are not exceeded
    - The LV cable(s) shall not be loaded more than 80% of its rated capacity.
    - The Distribution Pillars shall not be loaded more than 80% of its rated capacity.
    - The loading of the Distribution Transformers shall not exceed 80% of full load rated capacity (KVA)
- Voltage Drops are within allowable limits
    - Service Voltage at customer supply interface point must be within ±5% of nominal voltage
    - Voltage Drop at customer supply interface point shall not exceed 5% of nominal voltage
- The design is the most economical (Low Cost) for the projected load and layout

2.3.1.2. PLANNING STANDARDS

The below sub-section outlines the main Distribution Planning Standards (DPS 01-04) and gives a brief outline of their scope. Network planning resources must be familiar with the outlined documents and must adhere to their specifications at all times when designing a new connection scheme.

- Distribution Planning Standards (DPS-01) – Estimation of Customer Load Guideline
    - This document deals with the estimation of…

- Connected Load
- Demand Load
- Coincident Demand Load

…for all categories of customers. It is applicable to all the existing and new customers to be supplied by SEC.

- Distribution Planning Standards (DPS-02) – Design Guideline Of Underground Low Voltage Network To Supply Customers
    - This guideline describes the standards and criteria for electrical design and planning of underground low voltage network and its layout to deliver the sufficient supply of electricity to new customers' loads within the defined standards limits of voltage and loading, and to maintain the reliability of power supply under all normal operating load and voltage conditions within the defined standards limits. It is intended to assist the planning engineers and field personnel to achieve standardization in design and planning and to ensure a satisfactory and economical level of service. It covers all types of supplying new customers with low voltage underground network including (used LV materials, configurations types, design principles and procedures, calculations, etc.).
- Distribution Planning Standards (DPS-03) – Design Guideline Of Overhead Line Low Voltage Network To Supply Customers
    - This guideline describes the standards and criteria for electrical design and planning of overhead low voltage network and its layout to deliver the sufficient supply of electricity to new customers' loads within the defined standards limits of voltage and loading, and to maintain the reliability of power supply under all normal operating load and voltage conditions within the defined standards limits. It is intended to assist the planning engineers and field personnel to achieve standardization in design and planning and to ensure a satisfactory and economical level of service. It covers all types of supplying new customers with low voltage overhead network including (used LV materials, configurations types, design principles and procedures calculations, etc.).
- Distribution Planning Standards (DPS-04) – Guideline For Identification Of Low Voltage Network Elements For Different Voltages
    - The purpose of this document is to help identify the electrical elements which are the main concern of the Distribution Planning Guide Line and serve as a basis for unifying their symbols.

2.3.2. Network Planning & New Connection Design Procedure

After the site visit, a design proposal is to be prepared for the project.

2.3.2.1. DRAFTING DESIGN PROPOSAL

The drafting of the design consists of, but is not limited to, the following steps:

- Decide on the most appropriate equipment and network configurations and sizes in accordance with SEC network planning standards (SEC DPS 01-04). A project layout sketch is to be prepared. The design must specify the outlet number to which LV cables are to be connected at the distribution panel. Pole and equipment numbers are to be added at a later stage. Major steps include
    - Examination of contracted load, demand load, and circuit breaker (CB) size based on DEG-1 and with reference to the NOC application.
    - In case of essential information for engineering design not available in the file, it should be returned with objections to customer service department, e.g. load clarification required from customer. Otherwise, engineering design is commenced.
    - Preparation of the connection design based on demand load and on information collected per site visit check list (Figure 26). KWH meter and size of circuit breaker shall be as per customer's contracted load.
- Carry out design calculations in accordance with design guidelines issued by the network planning division and the Distribution Engineering Department (D.E.D.). If necessary, modify the design proposal until the required design guidelines are met.
- Prepare Rights of Way (ROW) application for overhead sections of the project, if applicable.
    - Any special instructions which are required for construction (e.g. Special requirements for access to property, obstructions to be avoided, etc.) Are to be included on the design checklist/transmittal form.
- Checks that associated project work is completed or scheduled.
- Prepare a cost estimate for the project.

2.3.3. DESIGN OF LV UNDERGROUND SCHEMES

This section illustrates the step by step design procedures for LV underground networks. For more details kindly refer to documents DPS – 02.

2.3.3.1. UNDERGROUND LOW VOLTAGE NETWORK CONFIGURATION

There are three standard connection configuration types for customer connections in Low Voltage Underground Network depends on customers demand loads as following.

Connection through Distribution Pillar

This type of connection is shown in Figure 4 and Figure 5. For this condition, cable 300 mm2 AL/XLPE is used from substation to distribution Pillar, and cables 185mm2 AL/XLPE, 70 mm2 AL/XLPE are used from distribution Pillar to the customer meter/meters box. (Common configuration).

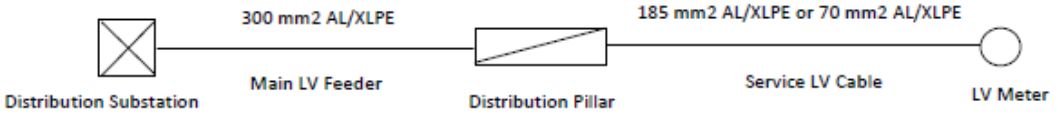


Figure 4: Technical connection through distribution pillar

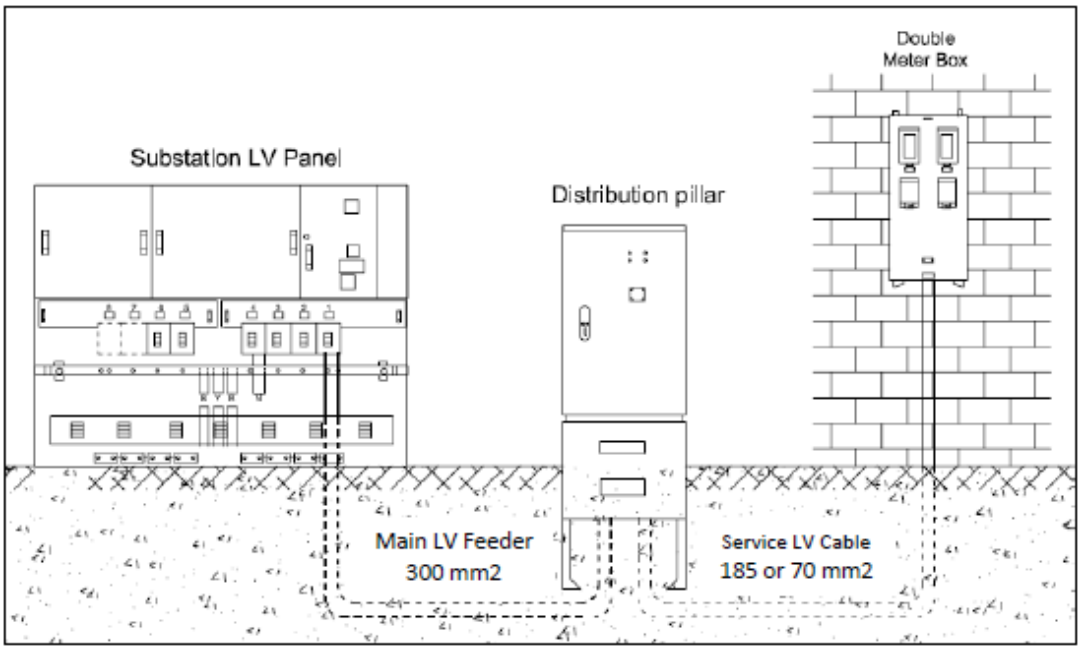


Figure 5: Scheme connection through distribution pillar

Direct Connection

This type of connection is shown in Figure 6 and Figure 7 . For this condition, cable 300 mm2 AL/XLPE is used directly from substation to the customer meter/meters box. (Heavy load lots only).

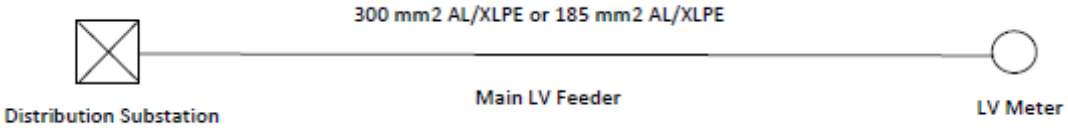


Figure 6: Technical direct connection

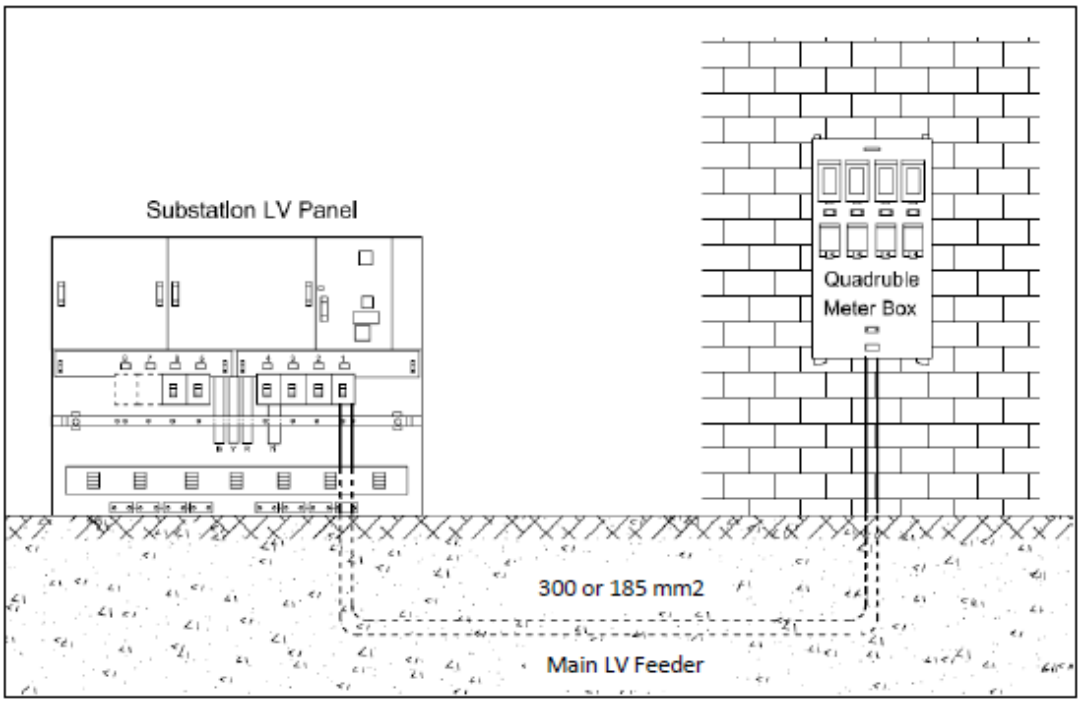


Figure 7: Scheme direct connection

Connection through Two Distribution Pillars

In the areas where load of customers is low, the outgoing of the distribution pillar can be used to feed the second distribution pillar to provide connection to more consumers. This type of connection is shown in Figure 8 and Figure 9. For this condition, cable 300 mm2 AL/XLPE is used from substation to the first distribution Pillar, and cables 300 mm2 AL/XLPE or 185 mm2 AL/XLPE are used from the first distribution Pillar to the second distribution Pillar and cables 185mm2 AL/XLPE or 70 mm2 AL/XLPE are used from distribution Pillar to the customer meter/meters box. (Light load lots only).

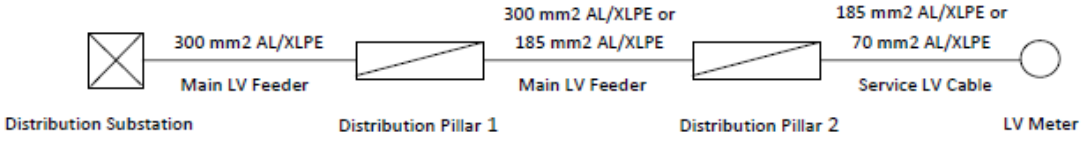


Figure 8: Technical connection through two distribution pillars

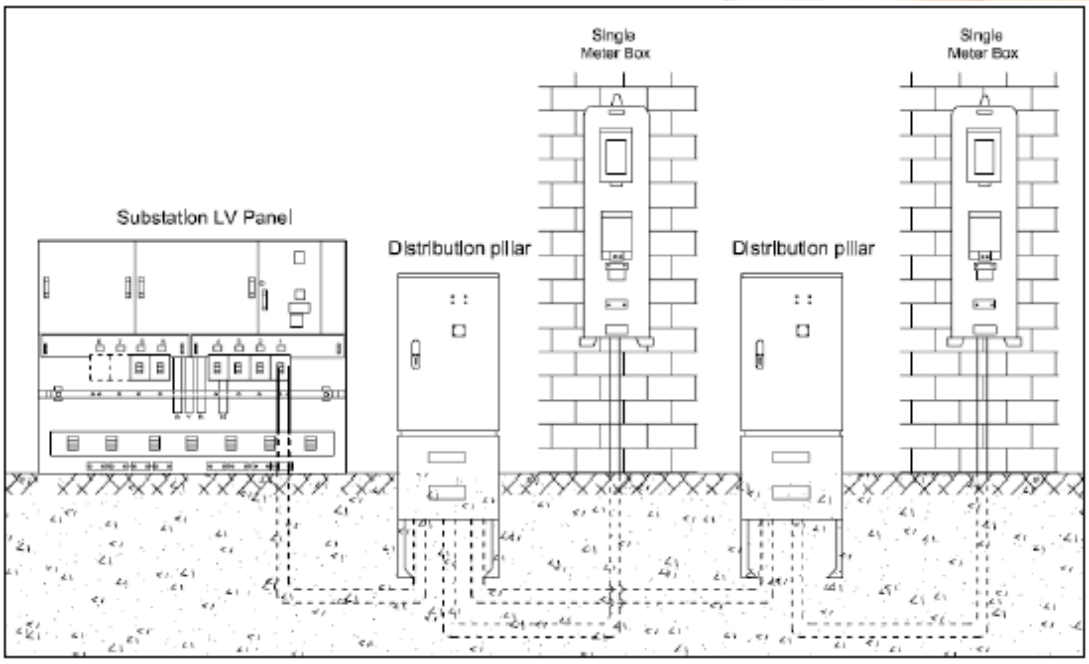


Figure 9: Scheme connection through two distribution pillars

2.3.3.2. STEP BY STEP DESIGN PROCEDURE – LV UNDERGROUND

1. Connected Load (CL) in (KVA) for each Individual unit in customer's building should be estimated, unit by unit, referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation Of Customer Load Guideline) with its latest updates.
2. Individual Circuit Breaker Rating (CBR) in (Amp) for the Individual KWH Meter for each Individual unit in customer's building should be determined according to the estimated connected load (CL) of that Individual unit and referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.
3. Number of Individual KWH Meters (N) required for the customer's building should be determined according to number of Individual units in customer's building and referring to SEC Customer Services Manual with its latest updates.
4. Calculate the Coincident Demand Load (CDL) in (Amp) for the group of all KWH Meters of the customer's building as follows:

$$CDL = \left(\sum_{i=1}^{N} CBR_i \times DF_i\right) \times CF(N)$$

Where:

- N = Number of Individual KWH Meters required for the customer's building.

- CBR_i = Circuit Breaker Rating in (Amp) for the Individual KWH Meter no. (i).
- DF_i = Demand Factor for the Individual KWH Meter no which should be determined according to the utilization nature of the concerned Individual unit no. in customer's building and referring to SEC Distribution Planning Standards No. (DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.
- CF (N) = Coincident Factor for the group of all KWH Meters of the customer's building which should be determined according to Number of these KWH Meters and referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.

$$CF(N) = \frac{\left(0.67 + \frac{0.33}{\sqrt{N}}\right)}{1.25}$$

$$For\ N = 1 \ \Rightarrow \ CF(N) = 1$$

5. Calculate the Coincident Demand Load (CDL) in (KVA) of the customer's building from the calculated Coincident Demand Load (CDL) in (Amp) as follows :

$$CDL_{in\ KVA} = \frac{CDL_{in\ AMP} \times V_{LL} \times \sqrt{3}}{1000}$$

Where:

- V_{LL} = Nominal Voltage (line to line) of the LV Network (in volts).

This equation can be simplified as follows:

$$CDL_{in\ KVA} = \frac{CDL_{in\ AMP}}{F_{Conversion}}$$

Where:

- $F_{Conversion}$ = Conversion Factor to convert (CDL) from (Amp) to (KVA). Its values for different nominal voltages are shown in Table 1 below.

Table 1: Conversion factors UG

Conversion factors $F_{Conversion}$	Standard nominal voltage		
	400	380	220
	1.443	1.519	2.624

6. Based on the calculated Coincident Demand Load (CDL) in (Amp) of the customer's building, select the suitable connection configuration type to supply this Coincident Demand Load (CDL) as shown in Table 2 hereunder. the suitable connection configuration type includes :
    - Size of cable to customer.
    - No. of cables to customer required.
    - Suitable supply source: Direct Feeder from Substation (SS) or Service Connection through Distribution Pillar (DP).
    - No. of outgoing required.

Table 2: Coincident Demand Load (CDL) UG

Coincident Demand Load (Amps)		Coincident Demand Load (KVA) for Different Voltages (V)						Supply Source	No. of Outgoing Fuses / MCCBs	No. of LV Cables to Customer	Size of LV Cables to Customer	Main LV Feeder	
		Standard Nominal Voltages (V)										No. of Cables to DP	Cable Size
		400 V		380 V		220 V							
From	To	From	To	From	To	From	To						
1	108	1	75	1	71	1	41	DP	1	1	70 mm^2	1	300 mm^2
109	184	76	127	72	121	42	70	DP	1	1	185 mm^2	1	300 mm^2
185	216	128	150	122	142	70	82	DP	2	2	70 mm^2	1	300 mm^2
217	248	150	172	143	163	83	95	DP	2	2	185 mm^2	1	300 mm^2
1	184	1	127	1	121	1	70	SS	1	1	185 mm^2	Direct Feeder	
185	248	128	172	122	163	70	95	SS	1	1	300 mm^2	Direct Feeder	
249	368	173	255	164	242	95	140	SS	2	2	185 mm^2	Direct Feeder	
369	496	256	344	243	326	141	189	SS	2	2	300 mm^2	Direct Feeder	

7. If the suitable connection configuration type is Service Connection through Distribution Pillar (DP), go to the next step.
8. First try to supply customer's CDL from existing nearby DP by using the following steps:
    - Select the nearest existing DP to the customer's location (as possible).
    - Calculate CDL on the DP including of all customers KWH Meters (concerned new customer + existing customers) supplied from this DP.
    - CDL on the DP should be not greater than DP's Firm Capacity (i.e. not exceed 80 % of DP's rating).
    - Calculate CDL on the Main Feeder (300 mm2 cable) from SS to DP including of all customers KWH Meters (concerned new customer + existing customers) supplied from this Main Feeder.

- CDL on the Main Feeder should be not greater than Main Feeder's Firm Capacity (i.e. not exceed 80 % of Main Feeder's rating).
- Calculate CDL on the SS including of all customers KWH Meters (concerned new customer + existing customers) supplied from this SS.
- CDL on the SS should be not greater than SS's Firm Capacity (i.e. not exceed 80 % of SS's rating).
- Select the shortest geographic route for the service cable from DP to customer's location (as possible).
- Calculate VD% on the Main Feeder (300 mm2 cable) from SS to DP.
- Calculate VD% on the service cable from DP to customer's location.
- Calculate the Total VD% from SS to customer's location.
- Total VD% from SS to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
- If customer's CDL cannot be supplied from the selected DP because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing DP (one by one) with priority for the nearest and by using same steps in above (from "a" to "l").

9. If customer's CDL cannot be supplied from all nearby existing DP because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
10. Try to supply customer's CDL from existing nearby SS through a new DP by using the following steps :
    - Select the nearest existing SS to the customer's location (as possible).
    - Calculate CDL on the SS including of all customers KWH Meters (concerned new customer + existing customers) supplied from this SS.
    - CDL on the SS should be not greater than SS's Firm Capacity (i.e. not exceed 80 % of SS's rating).
    - Design to install a new DP near to customers' lots in the center of loads (i.e. in the middle between customers' lots) as possible.
    - Select the shortest geographic route for the new Main Feeder (300 mm2 cable) from SS to the new DP (as possible).
    - Select the shortest geographic route for the service cable from the new DP to customer's location (as possible).
    - Calculate VD% on the new Main Feeder (300 mm2 cable) from SS to the new DP.

- Calculate VD% on the service cable from the new DP to customer's location.
- Calculate the Total VD% from SS to customer's location.
- Total VD% from SS to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
- If customer's CDL cannot be supplied from the selected SS because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing SS (one by one) with priority for the nearest and by using same steps in above (from "a" to "j").

11. If customer's CDL cannot be supplied from all nearby existing SS because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
12. Design to supply customer's CDL from a new SS through a new DP by using the following steps :
    - Design to install a new SS near to customers lots in the center of loads area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, empty lots) as possible.
    - Size (KVA rating) of the new SS should be selected based on the need of the neighbor area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, existing empty lots).
    - Design to install a new DP near to customers' lots in the center of loads (i.e. in the middle between customers' lots) as possible.
    - Select the shortest geographic route for the new Main Feeder (300 mm2 cable) from the new SS to the new DP (as possible).
    - Select the shortest geographic route for the service cable from the new DP to customer's location (as possible).
    - Calculate VD% on the new Main Feeder (300 mm2 cable) from the new SS to the new DP.
    - Calculate VD% on the service cable from the new DP to customer's location.
    - Calculate the Total VD% from the new SS to customer's location.
    - Total VD% from the new SS to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
13. If the suitable connection configuration type is Direct Feeder from Substation (SS), go to the next step.
14. First try to supply customer's CDL from existing nearby SS by using the following steps:
    - Select the nearest existing SS to the customer's location (as possible).

- Calculate CDL on the SS including of all customers KWH Meters (concerned new customer + existing customers) supplied from this SS.
- CDL on the SS should be not greater than SS's Firm Capacity (i.e. not exceed 80 % of SS's rating).
- Select the shortest geographic route for the Direct Feeder from SS to the customer's location (as possible).
- Calculate VD% on the Direct Feeder from SS to the customer's location.
- Total VD% from SS to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
- If customer's CDL cannot be supplied from the selected SS because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing SS (one by one) with priority for the nearest and by using same steps in above (from "a" to "f").

15. If customer's CDL cannot be supplied from all nearby existing SS because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
16. Design to supply customer's CDL from a new SS by using the following steps:
    - Design to install a new SS near to customers lots in the center of loads area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, empty lots) as possible.
    - Size (KVA rating) of the new SS should be selected based on the need of the neighbor area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, existing empty lots).
    - Select the shortest geographic route for the Direct Feeder from the new SS to the customer's location (as possible).
    - Calculate VD% on the Direct Feeder from the new SS to the customer's location.
    - Total VD% from the new SS to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
    -

2.3.4. Design of LV Overhead Schemes

This section illustrates the step by step design procedures for LV overhead networks. For more details kindly refer to documents DPS – 03.

2.3.4.1. Overhead Low Voltage Network Configuration

There are three standard configurations for customer low voltage overhead connections depending on customers demand loads as following.

OH Main Feeder with Service Drop 50 mm^2 Quadruplex Conductor

This type of configuration is shown in Figure 10. For this condition, Quadruplex Conductor 120 mm2 shall be used as main OH LV feeder from PMT LV cabinet to customer location, and Quadruplex Conductor 50 mm2 shall be used as service drop connection from that location to the customer meter/meters box. (Common configuration).

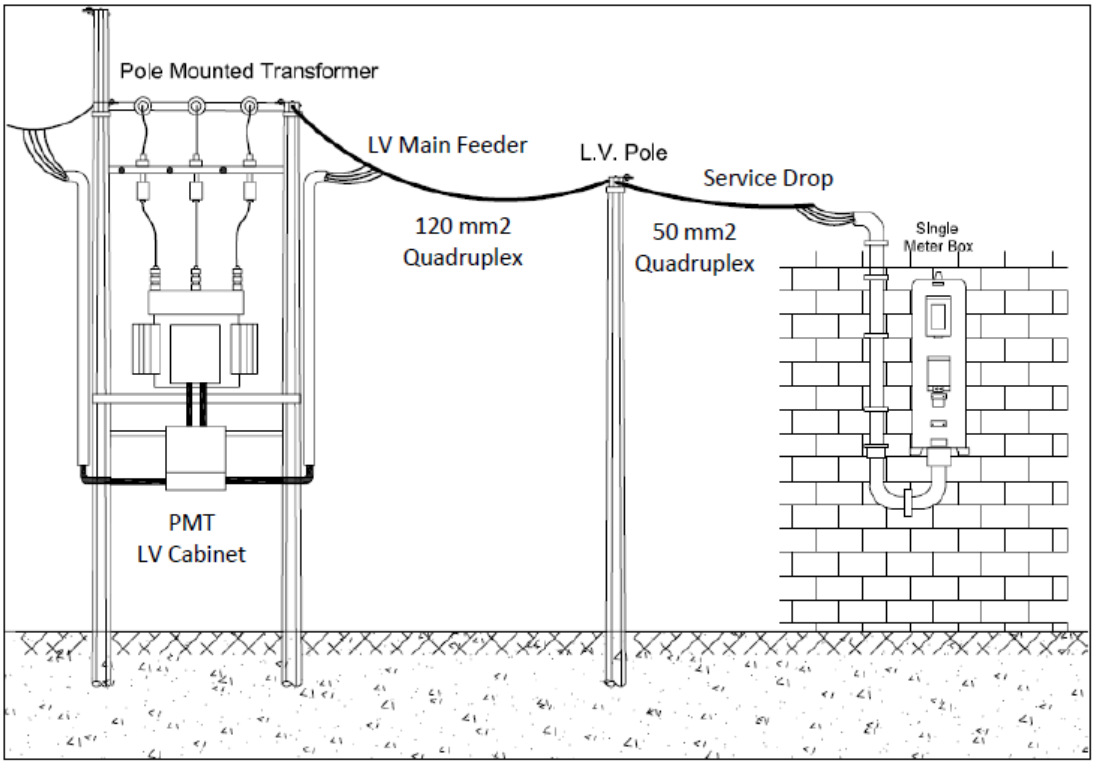


Figure 10: OH Main Feeder with Service Drop 50 mm2 Quadruplex Conductor

OH Main Feeder with Service Drop 120 mm^2 Quadruplex Conductor

This type of configuration can be used only when Quadruplex Conductor 50 mm2 is not sufficient to supply the customer demand load. It is shown in Figure 11. For this condition, Quadruplex Conductor 120 mm2 shall be used as main OH LV feeder from PMT LV cabinet to customer location, and Quadruplex Conductor 120 mm2 can also be used as service drop connection from that location to the customer meter/meters box. (Heavy load lots only).

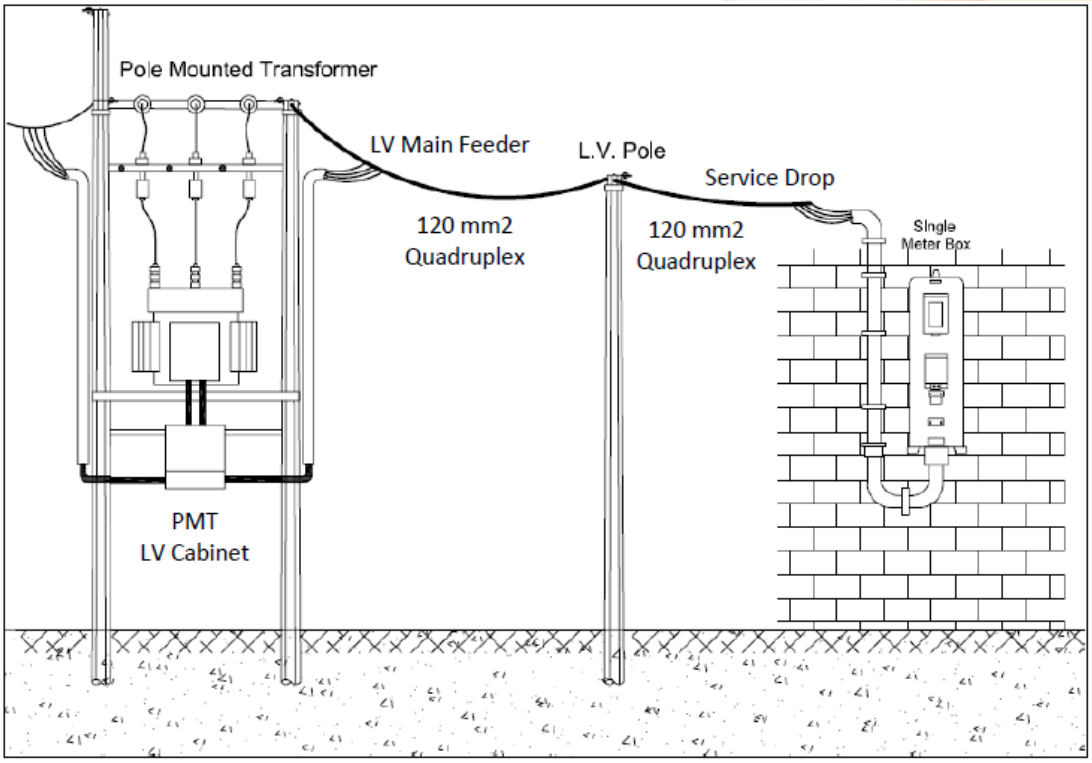


Figure 11: OH Main Feeder with Service Drop 120 mm2 Quadruplex Conductor

OH Main Feeder with Service Connection UG Cable

This type of configuration can be used only when there is a physical hindrance to use Quadruplex Conductor as service drop connection to the customer. It is shown in Figure 12. For this condition, Quadruplex Conductor 120 mm2 shall be used as main OH LV feeder from PMT LV cabinet to the nearest pole to customer location, and UG Cable 70 mm2 or 185 mm2 (depending on customer load) can be used as service connection from the nearest pole to the customer meter/meters box. (Exceptional configuration).

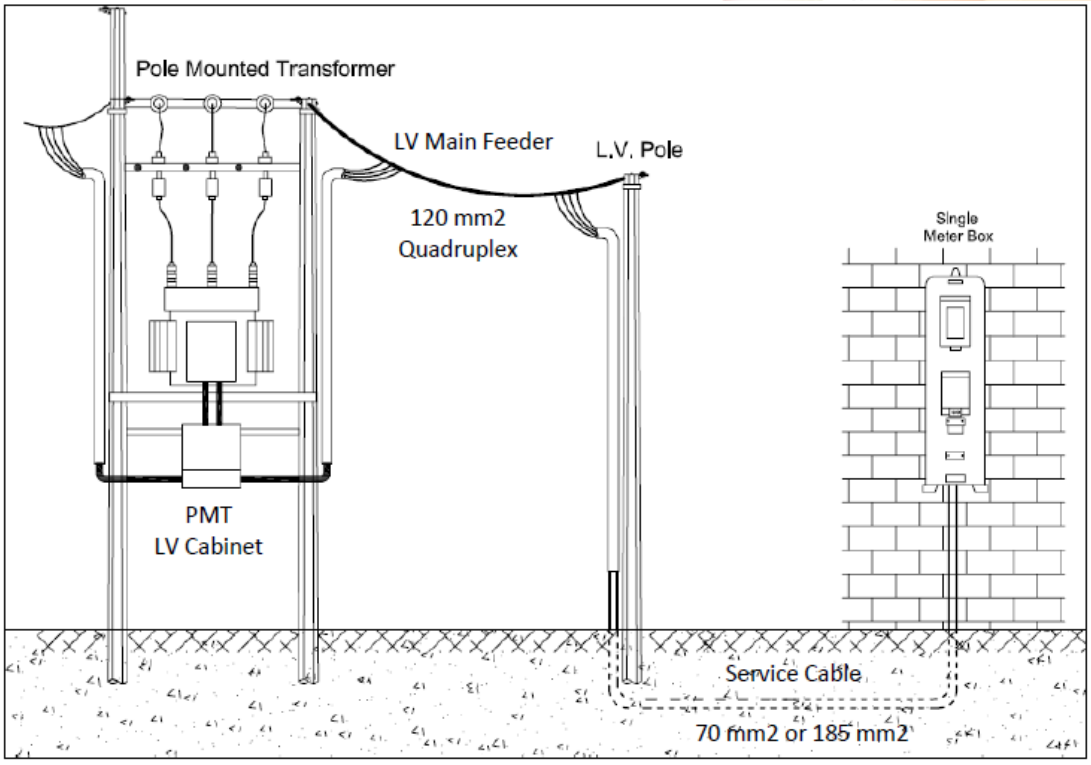


Figure 12: OH Main Feeder with Service Connection UG Cable

2.3.4.2. Step By Step Design Procedure – LV Overhead

1. Connected Load (CL) in (KVA) for each Individual unit in customer's building should be estimated, unit by unit, referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation Of Customer Load Guideline) with its latest updates.
2. Individual Circuit Breaker Rating (CBR) in (Amp) for the Individual KWH Meter for each Individual unit in customer's building should be determined according to the estimated connected load (CL) of that Individual unit and referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.
3. Number of Individual KWH Meters (N) required for the customer's building should be determined according to number of Individual units in customer's building and referring to SEC Customer Services Manual with its latest updates.
4. Calculate the Coincident Demand Load (CDL) in (Amp) for the group of all KWH Meters of the customer's building as follows:

$$CDL = \left(\sum_{i=1}^{N} CBR_i \times DF_i\right) \times CF(N)$$

Where:

- N = Number of Individual KWH Meters required for the customer's building.
- CBR_i = Circuit Breaker Rating in (Amp) for the Individual KWH Meter no. (i).
- DF_i = Demand Factor for the Individual KWH Meter no. which should be determined according to the utilization nature of the concerned Individual unit no. in customer's building and referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.
- CF (N) = Coincident Factor for the group of all KWH Meters of the customer's building which should be determined according to Number of these KWH Meters ( ) and referring to SEC Distribution Planning Standards No.(DPS-01, Rev. 01) titled (Estimation of Customer Load Guideline) with its latest updates.

$$CF(N) = \frac{\left(0.67 + \frac{0.33}{\sqrt{N}}\right)}{1.25}$$

$$For\ N = 1 \ \Rightarrow \ CF(N) = 1$$

5. Calculate the Coincident Demand Load (CDL) in (KVA) of the customer's building from the calculated Coincident Demand Load (CDL) in (Amp) as follows :

$$CDL_{in\ KVA} = \frac{CDL_{in\ AMP} \times V_{LL} \times \sqrt{3}}{1000}$$

Where:

- V_{LL} = Nominal Voltage (line to line) of the LV Network (in volts).

This equation can be simplified as follows:

$$CDL_{in\ KVA} = \frac{CDL_{in\ AMP}}{F_{Conversion}}$$

Where:

- $F_{Conversion}$ = Conversion Factor to convert (CDL) from (Amp) to (KVA). Its values for different nominal voltages are shown in Table 3below.

Table 3: Conversion factor OH

Conversion factor $F_{Conversion}$	Standard nominal voltage		
	400	380	220
	1.443	1.519	2.624

6. Based on the calculated Coincident Demand Load (CDL) in (Amp) of the customer's building, select the suitable connection configuration type to supply this Coincident Demand Load (CDL) as shown in Table 4 hereunder. the suitable connection configuration type includes :
    - Size of conductor to customer.
    - No. of conductors to customer required.
    - Suitable supply source: Direct Feeder from PMT or Service Drop through LV Main Feeder.
    - No. of outgoing required.

Table 4: Coincident Demand Load (CDL) OH

Coincident Demand Load (Amps)		Coincident Demand Load (KVA) for Different Voltages (V)						Supply Source	No. of Outgoing MCCBs	No. of LV Conductors to Customer	Size of LV Conductors to Customer	Main OH LV Feeder	
		Standard Nominal Voltages (V)										No. of Conductors to OH	Conductor Size
		400 V		380 V		220 V							
From	To	From	To	From	To	From	To						
1	88	1	61	1	58	0	34	PMTDC	1	1	50 mm^2	1	120 mm^2
89	160	62	111	59	105	34	61	PMTDC	1	1	120 mm^2	1	120 mm^2
161	176	112	122	106	116	61	67	PMTDC	2	2	50 mm^2	2	120 mm^2
177	320	123	222	116	211	67	122	PMTDC	2	2	120 mm^2	2	120 mm^2
1	108	1	75	1	71	0	41	PMTDC	1	1	70 mm^2	1	120 mm^2
109	160	76	111	72	105	42	61	PMTDC	1	1	185 mm^2	1	120 mm^2
161	216	112	150	106	142	61	82	PMTDC	2	2	70 mm^2	2	120 mm^2
217	320	150	222	143	211	83	122	PMTDC	2	2	185 mm^2	2	120 mm^2
1	108	1	75	1	71	0	41	PMTDC	1	1	70 mm^2	Direct UG Feeder	
109	184	76	127	72	121	42	70	PMTDC	1	1	185 mm^2	Direct UG Feeder	
185	216	128	150	122	142	70	82	PMTDC	2	2	70 mm^2	Direct UG Feeder	
217	368	150	255	143	242	83	140	PMTDC	2	2	185 mm^2	Direct UG Feeder	

7. If the suitable connection configuration type is Service Drop through Main Feeder, go to the next step.

8. First try to supply customer's CDL from existing nearby Main Feeder by using the following steps:
    - Select the nearest existing Main Feeder to the customer's location (as possible).
    - Calculate CDL on the Main Feeder (120 mm2 cable) including of all customers KWH Meters (concerned new customer + existing customers) supplied from this Main Feeder.
    - CDL on the Main Feeder should be not greater than Main Feeder's Firm Capacity (i.e. not exceed 80 % of Main Feeder's rating).
    - Calculate CDL on the PMT including of all customers KWH Meters (concerned new customer + existing customers) supplied from this PMT.
    - CDL on the PMT should be not greater than PMT's Firm Capacity (i.e. not exceed 80 % of PMT's rating).
    - Select the shortest geographic route for the Service Drop from Main Feeder to customer's location (as possible).
    - Calculate VD% on the Main Feeder (120 mm2 cable) from PMT to customer's location.
    - Calculate VD% on the Service Drop from Main Feeder to customer's location.
    - Calculate the Total VD% from PMT to customer's location.
    - Total VD% from PMT to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
    - If customer's CDL cannot be supplied from the selected Main Feeder because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing Main Feeders (one by one) with priority for the nearest and by using same steps in above (from "a" to "j").
9. If customer's CDL cannot be supplied from all nearby existing Main Feeders because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
10. Try to supply customer's CDL from existing nearby PMT through a new Main Feeder by using the following steps:
    - Select the nearest existing PMT to the customer's location (as possible).
    - Calculate CDL on the PMT including of all customers KWH Meters (concerned new customer + existing customers) supplied from this PMT.
    - CDL on the PMT should be not greater than PMT's Firm Capacity (i.e. not exceed 80 % of PMT's rating).

- Select the shortest geographic route for the new Main Feeder (120 mm2 cable) from PMT to the customer's location (as possible).
- Select the shortest geographic route for the Service Drop from the new Main Feeder to customer's location (as possible).
- Calculate VD% on the new Main Feeder (120 mm2 cable) from PMT to customer's location.
- Calculate VD% on the Service Drop from the new Main Feeder to customer's location.
- Calculate the Total VD% from PMT to customer's location.
- Total VD% from PMT to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
- If customer's CDL cannot be supplied from the selected PMT because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing PMT (one by one) with priority for the nearest and by using same steps in above (from "a" to "i").

11. If customer's CDL cannot be supplied from all nearby existing PMT because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
12. Design to supply customer's CDL from a new PMT through a new Main Feeder by using the following steps:
    - Design to install a new PMT near to customers lots in the center of loads area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, empty lots) as possible.
    - Size (KVA rating) of the new PMT should be selected based on the need of the neighbor area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, existing empty lots).
    - Select the shortest geographic route for the new Main Feeder (120 mm2 cable) from the new PMT to the customer's location (as possible).
    - Select the shortest geographic route for the Service Drop from the new Main Feeder to customer's location (as possible).
    - Calculate VD% on the new Main Feeder (120 mm2 cable) from the new PMT to customer's location.
    - Calculate VD% on the Service Drop from the new Main Feeder to customer's location.
    - Calculate the Total VD% from the new PMT to customer's location.

- Total VD% from the new PMT to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).

13. If the suitable connection configuration type is Direct Feeder from PMT, go to the next step.
14. First try to supply customer's CDL from existing nearby PMT by using the following steps:
    - Select the nearest existing PMT to the customer's location (as possible).
    - Calculate CDL on the PMT including of all customers KWH Meters (concerned new customer + existing customers) supplied from this PMT.
    - CDL on the PMT should be not greater than PMT's Firm Capacity (i.e. not exceed 80 % of PMT's rating).
    - Select the shortest geographic route for the Direct Feeder from PMT to the customer's location (as possible).
    - Calculate VD% on the Direct Feeder from PMT to the customer's location.
    - Total VD% from PMT to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).
    - If customer's CDL cannot be supplied from the selected PMT because one of the criteria (Loading % , Voltage Drop %) is not satisfied , Try all others nearby existing PMTs (one by one) with priority for the nearest and by using same steps in above (from "a" to "f").
15. If customer's CDL cannot be supplied from all nearby existing PMTs because one of the criteria (Loading %, Voltage Drop %) is not satisfied, go to the next step.
16. Design to supply customer's CDL from a new PMT by using the following steps:
    - Design to install a new PMT near to customers lots in the center of loads area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, empty lots) as possible.
    - Size (KVA rating) of the new PMT should be selected based on the need of the neighbor area (including: concerned new customer, existing others nearby supply requests, nearby under constructions buildings, existing empty lots).
    - Select the shortest geographic route for the Direct Feeder from the new PMT to the customer's location (as possible).
    - Calculate VD% on the Direct Feeder from the new PMT to the customer's location.

- Total VD% from the new PMT to customer's location should be not greater than voltage drop limit (i.e. not exceed 5 %).

2.3.5. SUBSTATION ROOM REQUIREMENTS

Much of network planning unit's work associated with obtaining substation rooms from customers is carried out at the time customers apply for No Objection Certificate (NOC). The procedures for issuing NOCs are not covered in this document.

However, it is important to ensure that customer supplied substation rooms are available prior to release of the scheme for construction.

At the NOC stage the procedure used is as follows:

- The customer Applied Load is calculated to determine if a substation room is required (166 A or greater).
- The customer's building plan is examined to determine the location and dimensions of the substation room and an undertaking is obtained from the customer that he will supply the required space.
- If the size and dimension are standard, a standard layout drawing is given to the customer. However if they are nonstandard, a special substation room layout drawing is developed and given to the customer later. These latter cases must be minimized.

The procedure with regard to construction and acceptance of the substation room is as follows:

- When the customer signs the undertaking to provide the substation room, he must be requested to contact SEC at two stages for inspection of the substation room:
  - When the formwork for the foundation has been completed but before the foundation concrete is poured
  - When the substation room is 100% completed
- Either the design engineer or the civil engineer (depending in local procedures) must inspect the substation when notified by customer relations department.
- The Project which requires the substation room is not to be approved (or released in the case of customer Funded projects) until the substation room is certified as complete by the SEC inspector
- Under circumstances outlined in the customer service manual customers there is the possibility of exempting the customer from substation room if applied load greater than 166 kVA.

2.3.6. MATERIAL AVAILABILITY

It is a requirement of the project processing procedures that the network planning unit ensures that all necessary steps are taken to enable construction to execute the scheme when as soon as itis released.

With regard to checking the availability of materials, the procedures require that the availability of low turnover and nonstandard items is to be checked before release of the scheme to construction.

Arising from the Distribution Engineering Department analysis, the following recommendations are made with respect to ensuring that adequate materials are available to complete the construction program:

- Based on usage history and on information coordinated by Distribution Engineering Department (DED), SEC materials department must ensure that adequate materials are available in warehouses to satisfy ED requirements. This is achieved by means of the materials management in SAP. This is the system by which the network planner should ensure that nonstandard or critical materials are available.
- Planning section must discontinue the practice of keeping ledgers, registers etc. in which materials requirements are logged.
- Where non-standard or low turnover items are required for a project, their availability should be checked by Network Planning Section at an early stage in the design process and before release to construction. This need only be done on an exception basis - case by base.

2.3.7. DESIGN PROPOSAL REVIEW

In the case of large or complex projects, where a number of possible design alternatives may exist, the design proposal is to be reviewed by the network planning section head, before selecting the most appropriate and economic design.

Generally, for large or complex projects, the preferred outline design will have already been decided by project sections within the relevant D.E.D.

In the majority of cases, it is not expected that the network planning section head or any other senior engineer will need to review the design until the design review stage. (Section 2.4.2)

2.4. COST CALCULATION, REVIEW & DESIGN APPROVAL

To ensure that the actual cost of projects, including customer funded jobs, will not differ significantly from the estimated cost, the following procedure are sets out for implementation across all operating areas of SEC.

On completion of the design proposal and cost estimation the project is to be reviewed by the respective prior to drafting

2.4.1. COST CALCULATION PROCEDURE

The purpose of this procedure is to provide standard cost estimating guidelines for distribution projects initiated by SEC.

2.4.1.1. MATERIAL AND INVOICE COSTING

The module for the costing of new connection projects is integrated in UDS (Unified Distribution System), a software based solution.

The system is based on the concept of design assemblies for which the material components, total material cost and the installation cost are generated and available to the network planner.

The system uses the standard cost and design assembly manuals as database for its source of information for generating the following reports:

- Cost Estimate Reports
- Bill of Materials Report
- Technical & Financial Approval Form

The standard cost estimating procedure flow chart as shown in Figure 13, depicts the detailed steps of the procedure as follows:

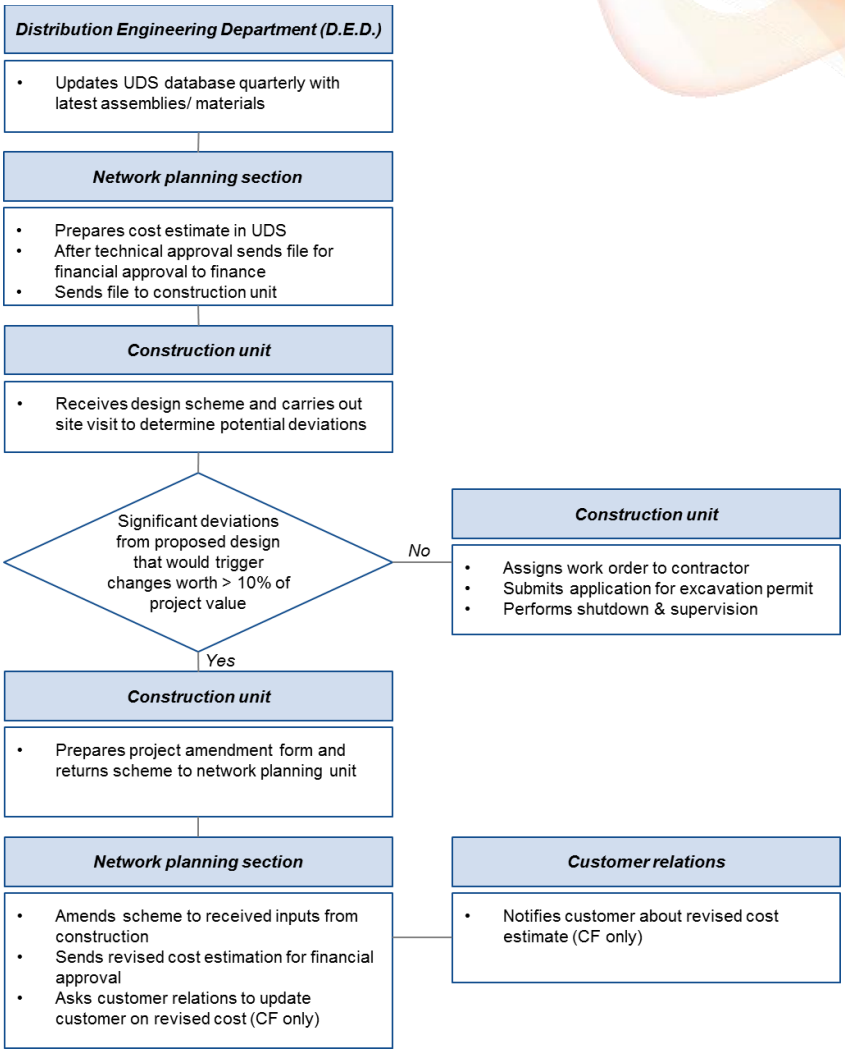

Distribution Engineering Department (D.E.D.)
• Updates UDS database quarterly with latest assemblies/ materials
Network planning section
• Prepares cost estimate in UDS
• After technical approval sends file for financial approval to finance
• Sends file to construction unit
Construction unit
• Receives design scheme and carries out site visit to determine potential deviations
Significant deviations from proposed design that would trigger changes worth > 10% of project value
No
Construction unit
• Assigns work order to contractor
• Submits application for excavation permit
• Performs shutdown & supervision
Yes
Construction unit
• Prepares project amendment form and returns scheme to network planning unit
Network planning section
• Amends scheme to received inputs from construction
• Sends revised cost estimation for financial approval
• Asks customer relations to update customer on revised cost (CF only)
Customer relations
• Notifies customer about revised cost estimate (CF only)

Figure 13: Standard cost estimating procedure

The manuals which should be used as reference for UDS are described below:

- Design Assembly Manual
    - The design assembly manual contains the detailed material breakdown of each assembly. Associated unit rate contract item reference numbers are also included. This manual is indexed according to the hierarchical numbering system. This provides a cross reference between the design assembly manual and the standard cost manual.
- Standard Cost Manual
    - The standard cost manual contains assembly descriptions, unit rate contract item reference numbers and material and labor costs. The manual is indexed using the

same numbering system as in the design assembly manual resulting in listings of related assemblies as in the design assembly manual.

The material price file in the database of the system is updated quarterly by the D.E.D. The system also includes function whereby E.D.s can monitor and update major material items periodically.

2.4.1.2. OVERHEADS

Overheads are defined as costs which are not directly attributable to an individual project.

Generally, there are two types of overhead costs currently in use in SEC:

- Engineering and construction overhead (ECO)
- Material overhead (MO)

SEC controlling department in consultation with the all operating areas and D.E.D.s is responsible for deciding on applicable overhead charges at a continuous basis.

As per the current guideline issued, the material overhead (MO) stands at 26% for materials issued from the warehouses, while the engineering and construction overhead is variable for each area.

2.4.1.3. COST ESTIMATES

There are currently two different a cost estimates which are separate and which should not be confused.

- Total project cost estimate
- Total cost estimate chargeable to customers

Total Project Cost Estimate

The total project cost estimate is derived as per Figure 14.

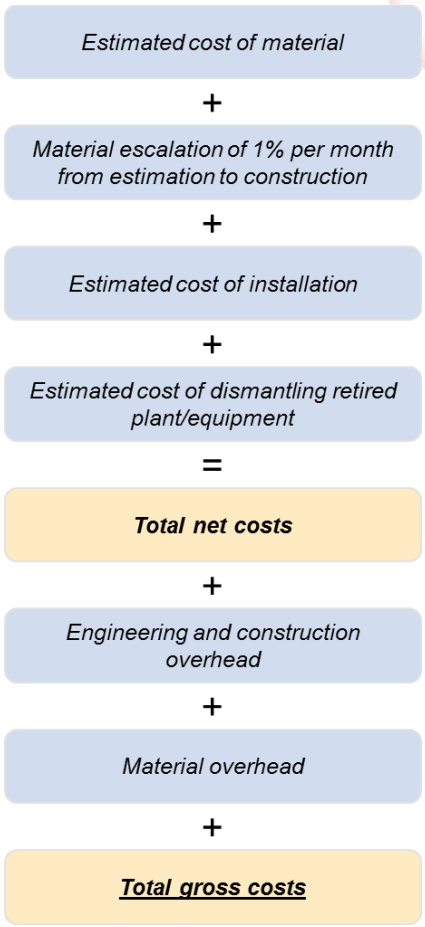


Figure 14: Total project cost estimate

Customer Cost Estimate

The cost estimate which is chargeable to the customer in customer funded cases is derived as per Figure 15.

The final costs to the customer, which is determined once the project is completed, the estimated if the customer receives a payback or needs to provide extra funds. It is determined by the cost of materials used by contractor plus any invoice cost and cost of materials. Additionally a surcharge of 15% of materials used by SEC staff is applicable for the customer. From the sum of these any credit value for retired equipment/plant need to be deducted.

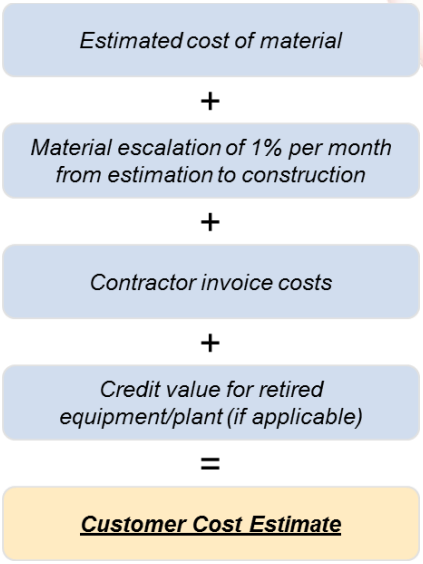


Figure 15: Customer cost estimate

2.4.2. DESIGN REVIEW

On completion of the design proposal and cost estimate the scheme is to be reviewed by an engineer, in case it was not drafted by the same, prior to approval.

For large projects, including components for non-standard HV networks or cases where difficulties are anticipated during construction, the proposal is to be discussed with the network planning section head. Generally, the design review should be carried out not less than one step below approval level.

All jobs, except for new/increased supplies, which involve additions/alterations to the HV / MV network, must be referred to the planning unit in the D.E.D. at the design review stage. The planning unit will then indicate their approval or otherwise by signing off the project layout sketch.

For cases of supply from the distribution system where the proposed network installation is not catered for in the 5-year network plan and the proposed load is in excess of 3 MVA installed load (or 2 MVA estimated demand), the project design proposal must.be submitted to planning division or the respective D.E.D for review and concurrence with the guidelines for power supply to customers.

The review process must consider the following key points:

- Establish that the most economical solution is provided. In cases of doubt, an alternative design proposal and cost estimate may be requested. The number of these cases should be small since cases requiring alternative proposals to be developed will normally be identified at an earlier stage during the regular reviews of job progress.

- Establish that the design proposal conforms to SEC standards and design practices.
- Confirm that the cost estimate has been completed correctly and that the design is prepared.to the appropriate level of detail to forward for approval.
- Confirm the project is correctly categorized to ensure costs are correctly allocated during the construction phase.
- Confirm the proposed funding of the project in accordance with the guidelines in the customer services manual.

After Design Review, the Design Engineer must:

Assign equipment numbers and enter the details in the substation register. The identification numbers of substations, mini-pillars and poles are to be shown on the Project scheme(s). The numbering system for mini-pillars is specified in DPS 02. The numbering system for poles is specified in DPS 03

Initiate a request for the drafting of the proposed project scheme, if necessary.

2.4.3. Rights Of Way Request

When the design review has been completed, a request for ROW's can be made through customer relations unit using design proposal schemes if necessary.

The date on which the request is sent to customer relations is to be noted in UDS, and a copy of the standard covering letters to be retained in the file.

In some cases, it may be decided that drafting be done before obtaining ROW approval. In such cases, the finished project drawing (or sketch for mini-project) may be used for ROW request. For customer funded cases, ROW request/approval should be carried out prior to the customer undertakings.

A design engineer is to provide assistance as necessary to customer relation in clearing the ROW request. When ROW request have been cleared by customer relations, the ROW drawings/documents are to be returned to the planning section. The drawings/ documents are to be retained in the design file for later use when applying for digging permits.

The date of receipt of ROW is to be noted in UDS again.

2.4.4. Construction Package Assembly & Pre Approval Checks

Prior to approval and release, final checks on the scheme are to be carried out by the network planning technician/ engineer:

- Project scheme/ drawings must be completed and verified

- A cost estimate must be completed and the relevant cost estimate forms/ cost estimate reports from UDS must be present
- Listing of Materials
- All ROW requests must be cleared
- In customer funded cases, payment must be received. Evidence of payment (receipt or commitment) must be present UDS
- Substation rooms must be 100% completed and certified
- Scope of work (for overhead network only) must be completed
- Check that concurrence has been obtained for the design from planning division, Distribution Engineering Department (DED), where required

Any remaining problems must be resolved at this stage including the following:

- Ensure site leveling is completed where relevant and that site problems in general are cleared
- Confirm materials availability for slow moving or nonstandard items

Appropriate action is to be initiated by the Design Engineer to clear outstanding problems as soon as possible.

The Design Engineer must then:

- Prepare the technical & financial approval form or include the already approved technical and financial form in customer funded cases
- Ensure that all documentation is available in UDS
- Ensure that any special instructions for the construction phase of the job are noted in UDS
- Ensure that all the components of the construction package/ assemblies are present
- Grouping of associated projects together in UDS via number link

2.4.5. Scheme Design And Cost Approval

As soon as the scheme design and the cost calculations are done, the scheme must be forwarded to the respective authority which performs the technical and financial approvals. The standard technical and financial approval is obligatory for all new connection requests, i.e. SEC and customer funded. The approval process is further split into the technical approval of the scheme and the financial approval of associated cost/ the customer charges.

Technical Approval Process

The technical approval is generally done via UDS. Once the scheme is competed and cost has been calculated, it is forwarded to the respective approval authority which needs to approve directly in UDS. UDS is also able to produce a hard copy which is also acceptable for approval use.

The respective approval authority is obliged to at least check the below main points of the scheme:

- Project number
- Project name, location, district, budget category
- Short description of scope of project (if applicable)
- Purpose of project
- Design & assemblies/ selected materials
- Associated project numbers
- Date supply/energization required
- Total cost of project
- Amount(s) chargeable to customer(s)

Technical Approval Authority Levels

The approval authority levels for appropriations relating to distribution capital projects are detailed as per the below Table 5 and in the corporate approval authority document. The basis of the determined authority is always by the total gross project costs.

Approval level	Approval authority	Status
≤ 10,000 SAR	Network planning section head	New
≤ 50,000 SAR	Service office manager	New
> 50,000 SAR	No change in approval structure	No change

Table 5: Approval levels

Financial Approval

As per the updated new connection process blueprint, the financial approval of the customer charges, which has previously been done by the finance/ customer relation departments of the respective E.D.s, is now integrated with the technical approval for all new connection requests with a total cost of ≤ 10,000 SAR.

For all new connection requests with a value of above 10,000 SAR the standard approval process stays in place, which requires the finance/ customer relation departments of the respective E.D. to approve.

2.4.6. CUSTOMER CHARGES

Once the connection design has been approved it is forwarded to customer service unit. It then determines the connection charges in accordance with the customer service manual and the contracted load.

For new connection requests ≤ 10,000 SAR the calculation of connection charges is done within the technical approval phase.

The customer service unit also checks that the customer has completed all outstanding works. If so, it advises the customer of connection charges, which will be due, and of the Baladiyah cleaning certificate, which will be required after the meter installation has been completed to be energized.

2.5. DISTRIBUTION OF DOCUMENTS

As soon as the connection design and cost calculations are approved by the respective authorities, all relevant design documents need to be shared with related departments. All documents should be stored within UDS and therefore should be able to be transferred electronically only. The main recipients of the design documents are the construction unit, the O&M section as well as the accounting department.

2.5.1. CONSTRUCTION UNIT

The below sections outline the standard set of documents which must be produced in within the connection design phase for onward transmission to construction unit following final scheme approval.

- Project Layout/ Scheme

This is a geographic drawing or sketch/ in GIS if available which is to contain details of the actual locations of existing and proposed cables, overhead lines and equipment relative to local geographic/building features.

- Single Line Diagram (where necessary)

This is a schematic drawing giving details of the electrical configuration of the relevant portions of the existing network and the proposed new network, in single line format. This drawing will only be required where the electrical configuration is not clear on the project layout.

- Feeder Schematic (where necessary)

This is a section of the HV Operations Drawing which shows the relevant portions of the HV network and proposed alterations. This drawing is only required for complex/large jobs involving multiple changes to the feeder network.

- Scope of Work (overhead)

A scope of work Form is required for overhead network sections of projects. It lists poles, pole numbers, span data and indicates pole construction information etc. Pole numbers are also included on the scheme.

- ROW Drawing/Sketch

The sketch/ drawing which indicates the equipment and cables for which ROW is required. The same sketches/drawing or the project layout drawing may be used later for requesting digging permit.

- Cost Estimates Forms

The output from UDS will include detailed cost estimate sheets, cost summary sheet, bill of materials and T&FA form.

- Design Checklist/ Transmittal Form (optional)

May be used as a checklist to ensure essential tasks are completed by planning section before transmitting the construction package to construction unit.

- Substation Acceptance (where necessary)

Substation rooms are to be inspected at critical points during construction to ensure that SEC requirements and standards are met. This also includes substation buildings provided by customers at SEC request. The Substation Acceptance Form will be used to certify that the substation room meets requirements.

- Letter for substation Room Rent (where necessary)

When other customers are being proposed to be supplied from a customer provided transformer room, Network Planning unit should initiate a letter to customer relations for paying the customer the appropriate room rent.

2.5.2. O&M SECTION

- Project Layout Drawing/ Scheme
- Single Line Diagram (where necessary)
- Feeder Schematic (where necessary)

2.5.3. AREA GENERAL ACCOUNTING

- Technical & Financial Approval Form
- Cost Summary

After release of the project, the remaining documentation and Network Planning Section copies are to be retained in the Design file which is to be filed under. Design Number or by substation file number as appropriate.

2.5.4. PROJECTS REFERRED BACK FROM CONSTRUCTION

The main objective of the Project processing procedures is to prepare Projects for immediate execution by Construction. The Construction Package has been defined to facilitate installation requirements. The procedures have been specified to ensure that all problems are cleared before projects are released to construction section. Therefore, it is expected that the number of projects referred back to network planning for design change due to construction problems will be small.

However, there will be a need to amend the design in some cases.

It is neither practical nor desirable to refer all projects which require design changes back to network planning section. Some Projects will require only minor changes and these should be dealt with by construction without reference to network planning. These cases include:

- Minor cable diversions from the design route to bypass hidden obstructions.
- Change in the position of mini-pillars (within 3 meters of the design positions).
- Changes in soil type (sandy to rocky) along a cable route except where construction consider that an alternative route will be less expensive and/or reduce the installation time. The scheme may then be referred back to network planning for possible redesign.

In all other cases the scheme is to be referred back to network planning. This includes customer funded projects where a design revision, due to change in site conditions, etc., will increase the estimated cost above SR 5,000.

To record receipt and subsequent progress of projects which are referred back to network planning a separate section is to be reserved in the UDS. The receipt of the scheme is to be noted in UDS and it is to be allocated to the relevant network planner by the senior network planner.

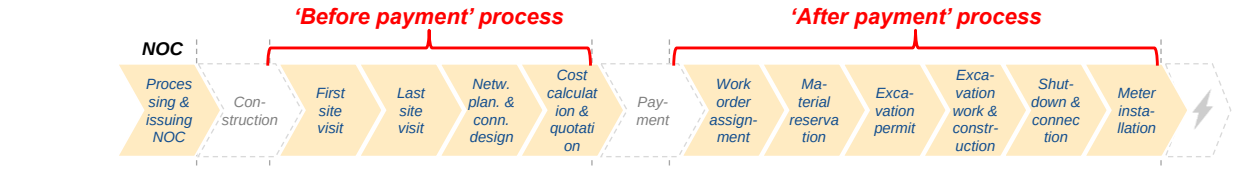
The original design number and project number should be retained for the scheme. In general, schemes returned from construction must be given a high priority in network planning.

2.6. NEW CONNECTION TIME NORMS – 'BEFORE PAYMENT' PROCESS

As per the outcome of the 'New Connection Process Streamlining' Project under the Sirius imitative, time norms and KPIs for each step of the before and after payment process have been defined.

Figure 16 outlines those time norms for standard connection requests within the network zone and a total requested load of below 166 kVA. Additionally, these time norms are only applicable for requests where the construction of a new sub-station is not required.

In net working days



	New connection process									Total
Current process	3		19	5	27	5	7	5	24	**95**
SEC Dis. control	◔		◔	●	●	●	◔	●	◔ *For excavation permit* ◕ *For construction work*	
Optimization measures	-		*-19*	*-3*	*-14*	*-4*	-	*-3*	*-11[1)2)]*	***-54***
Optimized process	**3**		**-**	**2**	**13**	**1**	7	**2**	**13**	**41**
KPI setting[3)]	*-2*		-	*-1*	*-11*	-	-	*-1*	-	***-15***
Target process	***1***		**-**	***1***	***2***	***1***	7	***1***	***13***	***26***

Figure 16: Time norms - before payment

The time norms for before payment activities are as per the below:

- NOC
  - NOC issuing for standard connection should be done within <u>one working day</u>
- Site visit
  - As per the new process required information for network planning is collected already with the second thermal visit, this activity needs <u>not to be conducted</u> and therefore planning should start immediately after receiving the permanent supply request.

- Second site visit (if applicable in case of customer remarks)
    - In case of remarks, a second site visit must be conducted within one working day after the customer indicates to be ready
- Network planning & connection design
    - The design of the network scheme and the according selection of required assemblies must be done within two working days
- Technical and financial approval
    - All technical and financial design approvals must be performed within one working day

3. AFTER PAYMENT PROCESS – CONSTRUCTION

This chapter focuses on procedures and guidelines related to the 'after payment' part of the new connection process, i.e. the construction related activities. In detail the below process steps are targeted by the subsequent chapters as outlined in Figure 17.

- Work order approval, assignment & project scheduling
- Material reservation, issuing & control
- Application for excavation permits
- Excavation, construction & inspection
- Request for shut-down and energization
- Closing and contractor payment

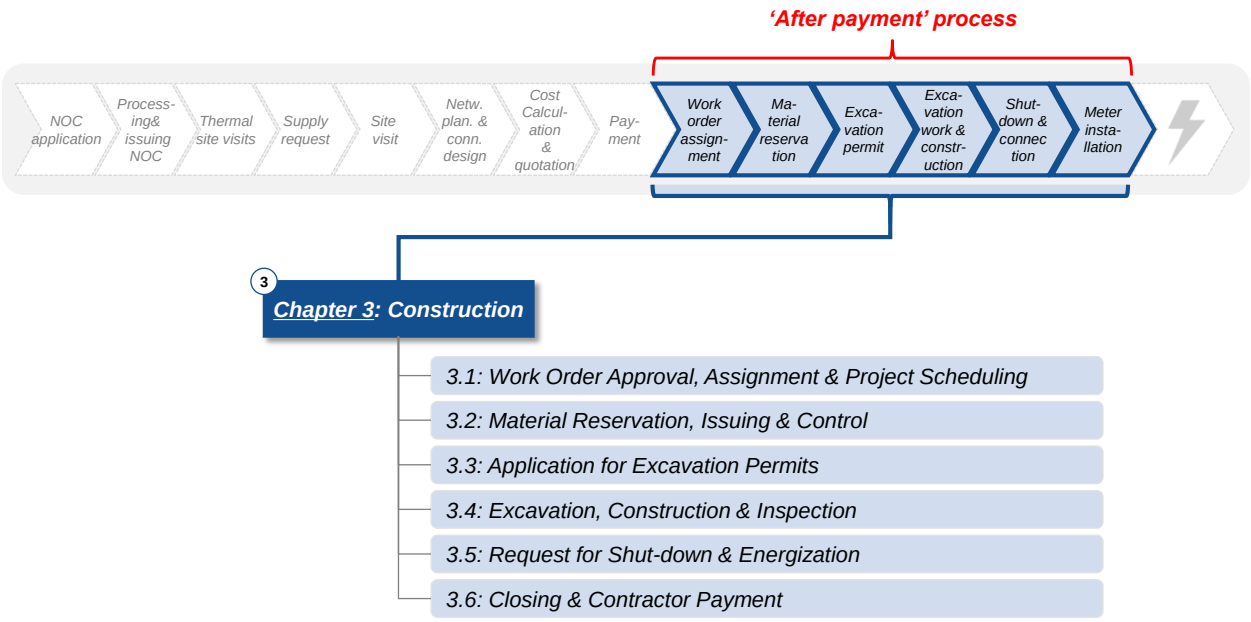


Figure 17: Overview 'after payment' process

The content for this section is based on the below outlined documents and has been updated and validated in accordance with the outcomes of the 'Distribution Excellence – New connection process streamlining' initiative. Documents include:

- SEC Distribution Construction Standard (SDCS)
  - SDCS-01: Construction Standard For Overhead Lines

- SDCS-02: Construction Standard For Underground Distribution Network (Parts 1 to 9)
- SDCS-03: Distribution Network Grounding Construction Standard (Parts 1 to 3)

3.1. WORK ORDER APPROVAL, ASSIGNMENT & PROJECT SCHEDULING

This section refers to the work orders for distribution construction work across all SEC areas.

The basic principle for processing work orders in is that work orders for projects shall be prepared by Construction Units and issued to contractors. In return, contractors shall submit every week to Construction Units the Work Order Status Report Summary to monitor the progress of Work Orders issued to them.

- Amendments to scheme designs
- Preparation of work orders
- Work order assignment
- Project scheduling

3.1.1. AMENDMENTS TO SCHEME DESIGNS

Following receipt of construction package from the network planning section, the construction unit, may, during the course of the preconstruction site visit, find that due to site conditions, inadequate design preparation or other reasons, adjustments or additions to the project may be necessary.

If it is clear, before construction starts, that there will be any deviation in the numbers of electrical equipment or a 10% deviation or more in cable length/ trench (subject to a lower limit of 10 meters and an upper limit of 200 meters), the project file needs be returned to the network planning unit for adaption and re-approval.

The network planning section will revise the design documents as well as the technical and financial Approval form, which needs to be re-signed at the appropriate approval level for the expenditure concerned.

The amended project file is then returned to construction unit.

If only during the course of the work, it becomes known that there will be any deviation in the numbers of electrical equipment or a 10% deviation or more in cable length/trench (subject to a lower limit of 10 meters and upper limit of 200 meters), a project amendment sheet must be completed by network planning section and needs to be uploaded within project file in UDS.

Notes:

- *Scheme amendment is not required for cases where cable deviation will be less than 10 meters even if it is 10% more than the total length.*
- *Scheme amendment is required for cases where cable deviation will be more than 200 meters even it is less than 10% of the total length.*

- *If amendments are required, it is essential that the technical and financial approval form is also prepared and re-signed by appropriate approval authority to document any deviations.*

3.1.2. Preparation Of Work Order

Based on the cost estimate sheets and on any deviations from design noted during the construction site visit, the site surveyor will prepare the work order including estimated value and estimated quantities of work items.

Note: New connections should, where possible, be limited in size to two to three items of HV equipment where needed and associated cabling and LV equipment. Limiting the size of projects and work orders helps to make the work easier to manage.

The below information needs to be prepared to finalize the preparation of the work order

- Indicate estimated value
    - The estimated value of the work order should be entered to enable authorization of the work order to be carried out according to SEC approval authority. The value will be taken from relevant cost estimate sheet as provided by network planning section.
- Initiated by/ date
    - Signed and dated by the person/Site Inspector who initiates the work order
- Reviewed by/Date
    - Signed and dated by the construction engineer who checks the work order
- Authorized By
    - Authorization of the work to be carried out should be according to SEC corporate approval authority based on the estimated value of the work order.

3.1.3. Work Order Assignment

On receipt of the scheme from network planning unit, the construction technician/ engineer examines and familiarizes him with the project. He indicates any known priorities, problems, etc. and sends the project to the construction unit head.

The construction unit head first task is to allocate the project to a Contractor. The method employed to allocate the project takes into account the outstanding work on hand with each contractor and on the contractors output. In accordance with SEC's contractor management philosophy, jobs should be allocated according to the recent performance of the contractor. Figure 18 gives an outline of this philosophy and also indicates level of supervision requires.

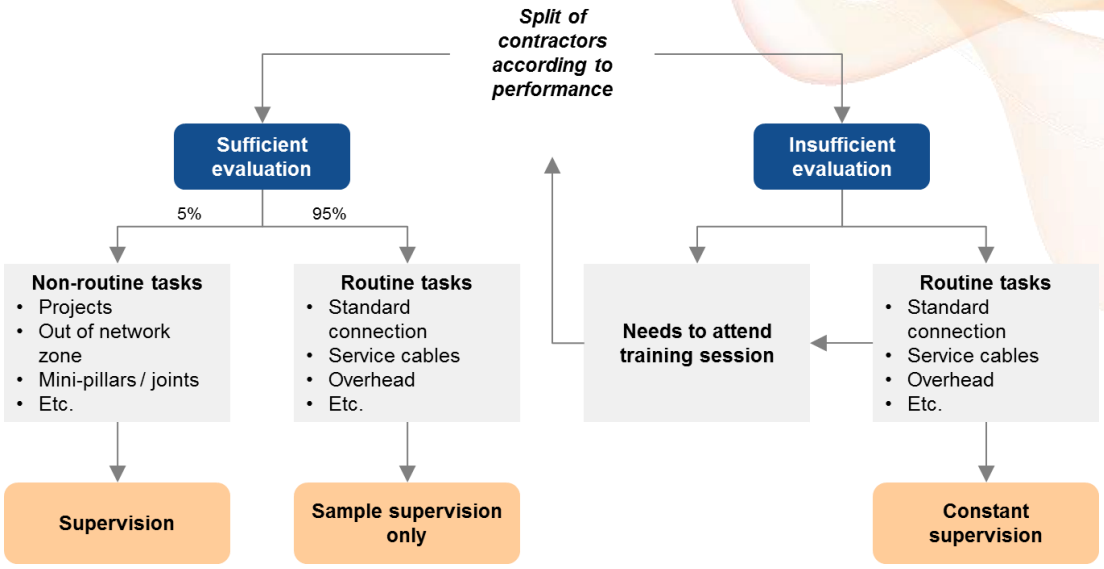


Figure 18: SEC contractor management philosophy

3.1.4. PROJECT SCHEDULING

The next step after allocating the project to a contractor is to schedule the. There are two levels of scheduling:

- Project Master Schedule
- Project Weekly Schedule

The Project Master Schedule is prepared monthly by the construction section head for each contractor. It includes all the active projects on hand and indicates the current SEC priorities for each project.

The office or construction manager must approve the Master Schedule which is then issued to the contractor. The construction section head must explain the priorities indicated and emphasize the need to meet targets and priorities established in the schedule. The office or construction manager head must formally review progress at least fortnightly with construction section head. This is in addition to more frequent informal reviews.

Projects which are received after the Master Schedule is approved and circulated are added by the construction section head to his copy of the Project Master Schedule for inclusion in the next month's Project Master Schedule.

The Project Weekly Schedule is the contractor’s day by day plan for realizing the work progress and targets set in the Project Master Schedule.

3.2. MATERIAL RESERVATION, ISSUING & CONTROL

The objectives of these procedures are:

- To adequately control the issue and use of materials on construction jobs.
- To verify that the material and invoice charges made to each job are correct.
- To streamline and standardize on paperwork systems associated with material control.
- To facilitate job closing and work order verification.

3.2.1. DETAILED MATERIAL PROCEDURE

1. Network planning section prepares a quantity list of materials (assemblies) for the job together with cost estimate as component parts of the construction package
2. The site engineer/site inspector to whom the job has been assigned carries out a site visit to check if job may proceed
    a. Where the site visit indicates that there will be any deviation in the numbers of electrical equipment or a 10% deviation or more in cable/trench length (subject to a lower limit of ten meters and an upper limit of 200 meters), the project file should be returned to network planning unit for amendments.
    b. Where deviations of less than 10% in cable/trench lengths are noted during preconstruction site visit, the site engineer/site inspector will amend the materials quantity list accordingly.
    c. For the detailed procedure on returning schemes from construction to network planning kindly refer to section 0 of this document.
3. The contractor receives the Work Orders and the relevant list of material quantities.
    a. The Work Order estimate of quantities should be in agreement with the list of materials quantities.
    b. The Contractor prepares the necessary MIRs (Material Issue Request), and submits to construction unit for approval.
4. Project clerk checks that the MIRs as prepared by the contractor are in accordance with the list of material quantities and that the correct charge number has been used on each MIR.
    a. The project clerk allocates a control number and arranges to have the MIRs approved by the appropriate approval level. He gives the copies to the Contractor.

5. The Contractor draws materials from the warehouse and proceeds with the work.
    a. Contractor access to the warehouse is now based on a flexible mode in which:
        i. SEC notifies contractor if material is ready for pick-up
        ii. SEC bundles as much material as possible per contractor
        iii. SEC assigns pick-up day and time to contractor

    Figure 19 illustrates the newly introduced material pick-up scheme.

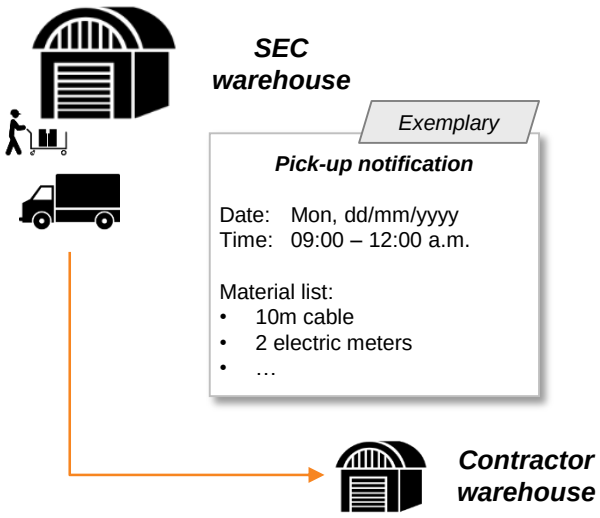


Figure 19: Overview contractor warehouse access

6. During the course of the work, the site inspector completes all necessary as-built reports and receives the concurrence of the contractor for the quantities of items of work completed. One copy of the as-built report is given to the contractor and one copy is given to the project clerk for the project file.
7. As each work order is physically completed, the site inspector completes all necessary as-built summaries and receives the concurrence of the contractor for the quantities of work completed. One copy of each as-built summary is given to the contractor and one copy is given to the project clerk for the project file.
8. Within one week of mechanical completion of service & meter jobs and mini-projects and within two weeks of mechanical completion of projects, the contractor submits material balance statement and associated materials documents, work order(s) showing quantities of work done, copies of as-built reports/ summaries and as-built drawings.
9. The project clerk or site inspector, depending on staff availability and local practice, will check:

a. That all material documents are checked against control number register.

b. That the MIRs submitted by the Contractor are same as copies of MIRs in project file.

   That the major items of materials, e.g. cables, equipment, poles, HV splices and terminations are the same for MIRs as issued from the warehouse, the as-built reports/summaries and the "Material Balance Statements".

c. That the Contractor claimed quantities of work done corresponds with the as-built report/summaries and with estimated quantities on the Work Order.

If no discrepancy exists, the site inspector will verify the Material Balance Statement and the Actual Quantities on the Work Order. The engineer will then approve the Material Balance Statement and the Actual Quantities on the Work Order.

Where a discrepancy occurs, the enquiry is directed to the site inspector and/or to the warehouse. It is preferable that any discrepancies which need to be referred to the Contractor should be handled by the concerned site inspector.

Where the Contractor submits a Material Balance Statement which does not account for all material transactions performed on the job or where a Material Document has been altered by the Contractor, the case is to be examined thoroughly and fully documented by the engineer. The Contractor must explain serious discrepancies in writing to the construction unit head. Abuses/repeated mistakes by the Contractor are to be followed by application of unsatisfactory performance reports in accordance with the SEC's contractor management scheme (Section 3.1.3).

When any discrepancies in claimed quantities of completed work and/or in materials deleted are resolved, the Work Order and Material Balance Statement are verified by the site inspector and approved by the engineer.

3.3. Application For Excavation Permits

In general, the applications for excavation permits are dominated by regional specificities in which the application is either done via a paper-based process or via an electronic portal and is either driven by SEC or by the contractor himself.

3.3.1. Standard Excavation Permit Application Procedure

If required by the local authority, the right-of-way (R-O-W) for the proposed route of an underground cable must be obtained from the concerned authority (e.g. municipality, other utilities and ministries) during planning stage of the project.

Given below is the procedure to be followed in obtaining excavation permits:

1. Prepare drawing proposed showing proposed route of the underground cable, cross-section of the trench or duct bank (if required) and location of other utilities (e.g. telephone, water, and sewer) lines along proposed route (if known).
2. Submit drawing to the relations section in the concerned operating area.
3. The actual construction work shall not be started until the digging permit from relevant authorities is obtained.
4. Enter submission date (later issuing date) in UDS

3.3.2. Permit Alignment Meetings with Municipalities

On top of the regular interactions with Amanas/ municipalities for permit applications a more structured meeting is to be conducted across E.D.s.

This aims at reducing the overall time for permit processing and issuing within the municipalities.

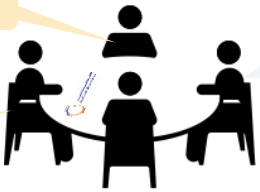
These meeting are supposed to happen on a monthly basis as well as ad-hoc when needed and comprise of senior representatives of SEC and municipalities. The objectives of these meetings are:

- Align on issues related to the new connection process
- Agree on internal municipality targets for issuing of permits
- Align on format to submit permits in most efficient way
- Discuss construction standards (e.g. re-asphalting)

Figure 20 summarizes the concept, participants as well as objectives

Alignment meetings with municipalities

Appointment of **municipality coordinator** in each E.D.



- Meetings to happen on a **regular basis** (monthly)
- **Ad-hoc meetings** with major issues are in place

SEC to **initiate** meetings with Amana/ Balladia in respective EDs/ service offices

Lead	Participants	Objectives
■ SEC E.D. manager / SEC service office manager ■ SEC new connection champion	■ SEC E.D. manager / SEC municipality coordinator ■ SEC service office managers ■ SEC new connection champion ■ Senior municipality representatives ■ Representatives from other utilities (if required)	■ Align on issues related to the new connection process ■ Agree on internal municipality targets for issuing of permits ■ Align on format to submit permits in most efficient way ■ Discuss construction standards (e.g. re-asphalting)

Figure 20: Overview permit alignment meetings

3.4. EXCAVATION, CONSTRUCTION & INSPECTION

Sit supervisors and inspectors for the unified contract work orders have an important role in correcting the company's contractor. Supervision work starts from the issuance of work order until it is completed by starting operation cycle and electrification. The responsibilities of supervising and inspection team who are overseeing the contractors' work are divided into two parts:

- Supervising the excavation and extension of network cables and connectors.
- Supervising the installation of equipment
- Supervising the civil construction works.
- Monitor the application of safety measures on site
- Coordinating for doing the required tests before operation to ensure work quality.

The objectives of the procedures are:

- To enable SEC to adequately monitor the quality of contractor work.
- To enable recording and certification of actual work completed.
- To provide a means for issuing work to the Inspectors.
- To streamline paperwork systems associated with site inspection and recording of as-built quantities.
- To facilitate job closing and work order verification.

The main principles of the procedures are:

- A weekly work schedule is given to each Inspector indicating those jobs he will inspect in the coming week.
- The Inspector must inspect certain defined activities on the job to ensure quality of contractor work.
- The Inspector records and certifies quantities for certain defined activities as the job proceeds and the remaining activities are recorded and certified at the end of the job.
- The Inspector records cable trench and rock excavation dimensions as the job proceeds. In general, cable laying measurements are made between electrical equipment installations after completion of that cable section.

  All measurements recorded by the Inspector are subject to final verification by the Foreman/Engineer.
- Emphasis is on ensuring, as far as possible, that the Inspector concentrates on inspecting the quality of contractor work as the job proceeds.

- The effectiveness of these procedures will depend on both the quality and commitment of the Inspector and also effective on-site supervision by supervisors and management.

3.4.1. Supervision Roles & Responsibilities

This section briefly outlines the roles and responsibilities for site inspector and construction supervisor.

3.4.1.1. Roles and Responsibilities – Construction Supervisor

The construction supervisor is responsible for engineering supervision in accordance with the authorities granted to him by the supervisory team. He will also be responsible for the teamwork to oversee the construction work orders, as well as overseeing the engineering supervision on performing the work orders for the unified contract.

The responsibilities can be outlined as follows:

1. Authorize the appropriate person to manage the supervisory team to decide on specific cases or take a decision without referring to him.
2. Approve and accept the issued work orders and materials in accordance with the specifications, charts and contract's terms and conditions.
3. Approve the preparatory work phase which covers the period from issuing the work order until actual start of work order implementation.
4. Approve the operational work phase starting from the project actual implementation (site handover), until the primary delivery of the site.
5. Review and confirm the work site, in which the work order has to be implemented.
6. Prepare the necessary reports for overseeing the contractor's supporting activities (submission and issuance of excavation permits)
7. Prepare the necessary reports for overseeing materials disbursement and return.
8. Review and approve the field reports, which are issued by the site inspector, competent engineer or the consultant responsible for the quality assurance of civil and electrical works.
9. Approve the project timeline, prepared by the contractor and site inspector, which outlines various implementation phases of the project.
10. Approve the operational and detailed plans prepared by the contractor
11. Approve the outcomes of implementation activities and site examination forms

12. Approve the work acceptance and issuance of preliminary taking over certificate and completion of work based on contract documents. These documents must be signed by the site inspector and the contractor's representative.

13. Review the contractor's payment requests and approve them after completing the work order according to the plans, conditions specifications, in line with the applicable admin and financial controls

3.4.1.2. ROLES AND RESPONSIBILITIES – SITE INSPECTOR

The responsibilities can be outlined as follows:

1. Receipt of approved work orders and examine the overhead / ground network routes and ensure that it is compatible with the approved study in accordance with the daily schedule.

2. Visit the work order site to ensure that there are no obstacles facing the implementation and site handover to contractor

3. Ensure that the contractor is committed to the instructions, laws and regulations issued by SEC and all concerned authorities.

4. To ensure that the contractor has got all necessary approvals and licenses to start his work

5. Ensure that the contractor has taken all necessary precautions to protect persons and equipment, and followed the applicable safety systems according to SEC instructions.

6. Ensure that the contractor has the proper and adequate workforce and equipment; so as to ensure continuous work execution according to a specific schedule matching the contract's terms and conditions.

7. Follow-up to the disbursement of work order materials and check them on site, and ensure their safety during implementation based on the approved specifications.

8. Determine the priorities of work orders assigned to the contractor and follow-up this in terms of time and work sites and according to the daily schedule approved by the construction supervisor.

9. Record the executing quantities on the ground for each work order and validate the implementation layouts with updating the modified quantities as per approved forms.

10. After approving the final implementation layout, the site inspector shall provide it to entity which is responsible for studies and planning to include it in the layouts (as ArcMap file) if the electricity department has the Geographic Information System (GIS). While it should be as (AutoCad) file, if the electricity department doesn't have (GIS), and it must be in conformity with the Satellite coordinates system used in SEC.

11. Prepare a written notice to the contractor to be approved by the supervisor or the authorized person to suspend the work order as per the approved form in case of any violations to the contract terms which are incompatible with the specifications and standards or if the contractor doesn't follow the SEC instructions.
12. Prepare of the necessary arrangements for disconnection and connection work and setting priorities in coordination with the relevant authorities in SEC according to the safety procedures with identifying the network part that will be subject to work.
14. Fill out the technical reports forms on field visits including work progress and to take notes on the implementation if any.
15. Ensure that the contractor has removed all violations in work sites in the required time and restore the site to what it was
16. Review of quantities form (measurements forms) after work completion, check and the sign the materials clearance forms, and prepare the preliminary take over and completion certificate.
17. Register the work order procedures in the (UDS) system with including notes, if any, and save all work order documents and forms in the archive system.
18. Fill out the violation form supported with photos (if any) during work implementation.

3.4.2. Site Inspection Procedure

The main features of the Site Inspection Procedures are summarized by examining the key activities performed by the Engineer, Foreman, Inspector and Contractor in the procedures.

3.4.2.1. Inspection Work Schedules

In the case of projects, the contractor submits a weekly schedule (as per Figure 30) of project work to the Construction Unit Head which must conform to the priorities set in the SEC approved Master Schedule. The Construction Unit Head approves the Weekly Schedule and issues a copy to the Inspector.

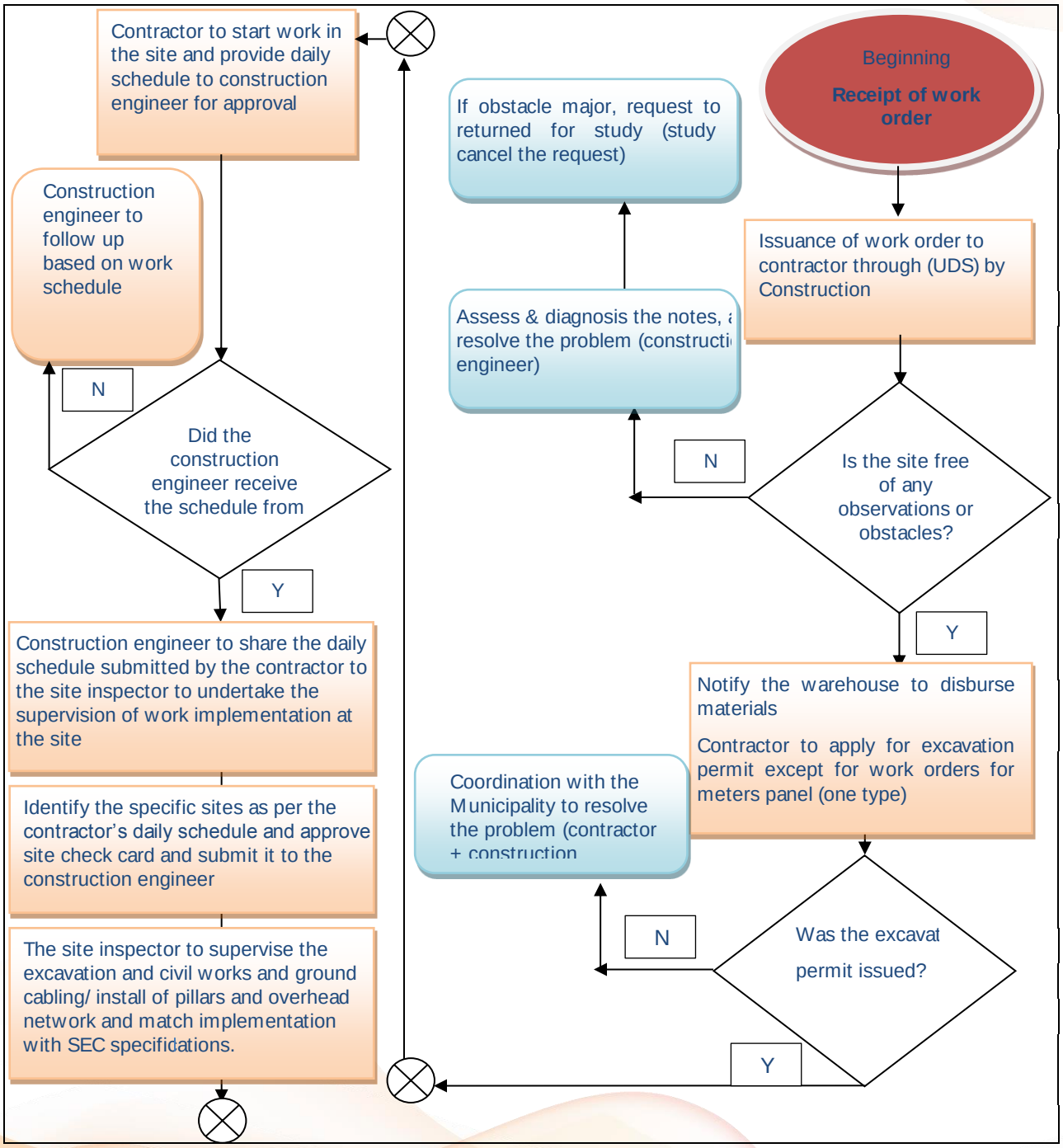
In the case of S&M jobs and Mini-Projects, Work Orders are issued to the selected contractors. The contractor will schedule the work in accordance with the validity dates of the excavation permit/ ROW where required.

In each case, the work schedule indicates the jobs on which the contractor will work in the coming week and which must be inspected by the Inspector. The Inspector will coordinate with the contractor to inspect the jobs as per schedule.

3.4.2.2. SITE INSPECTION WORK FLOW AND PROCEDURE

The work of construction supervisor and site inspector begins after the issuance of work order to the contractor until completion and hand over. This includes implementation supervision procedures and mechanisms as indicated in the below work flow.

Figure 21 outlines the inspection workflow:


Beginning
Receipt of work order
Issuance of work order to contractor through (UDS) by Construction
Is the site free of any observations or obstacles?
N
Assess & diagnosis the notes, a resolve the problem (constructi engineer)
If obstacle major, request to returned for study (study cancel the request)
Y
Notify the warehouse to disburse materials
Contractor to apply for excavation permit except for work orders for meters panel (one type)
Was the excavat permit issued?
N
Coordination with the Municipality to resolve the problem (contractor + construction
Y
Contractor to start work in the site and provide daily schedule to construction engineer for approval
Construction engineer to follow up based on work schedule
Did the construction engineer receive the schedule from
N
Y
Construction engineer to share the daily schedule submitted by the contractor to the site inspector to undertake the supervision of work implementation at the site
Identify the specific sites as per the contractor's daily schedule and approve site check card and submit it to the construction engineer
The site inspector to supervise the excavation and civil works and ground cabling/ install of pillars and overhead network and match implementation with SEC specifications.

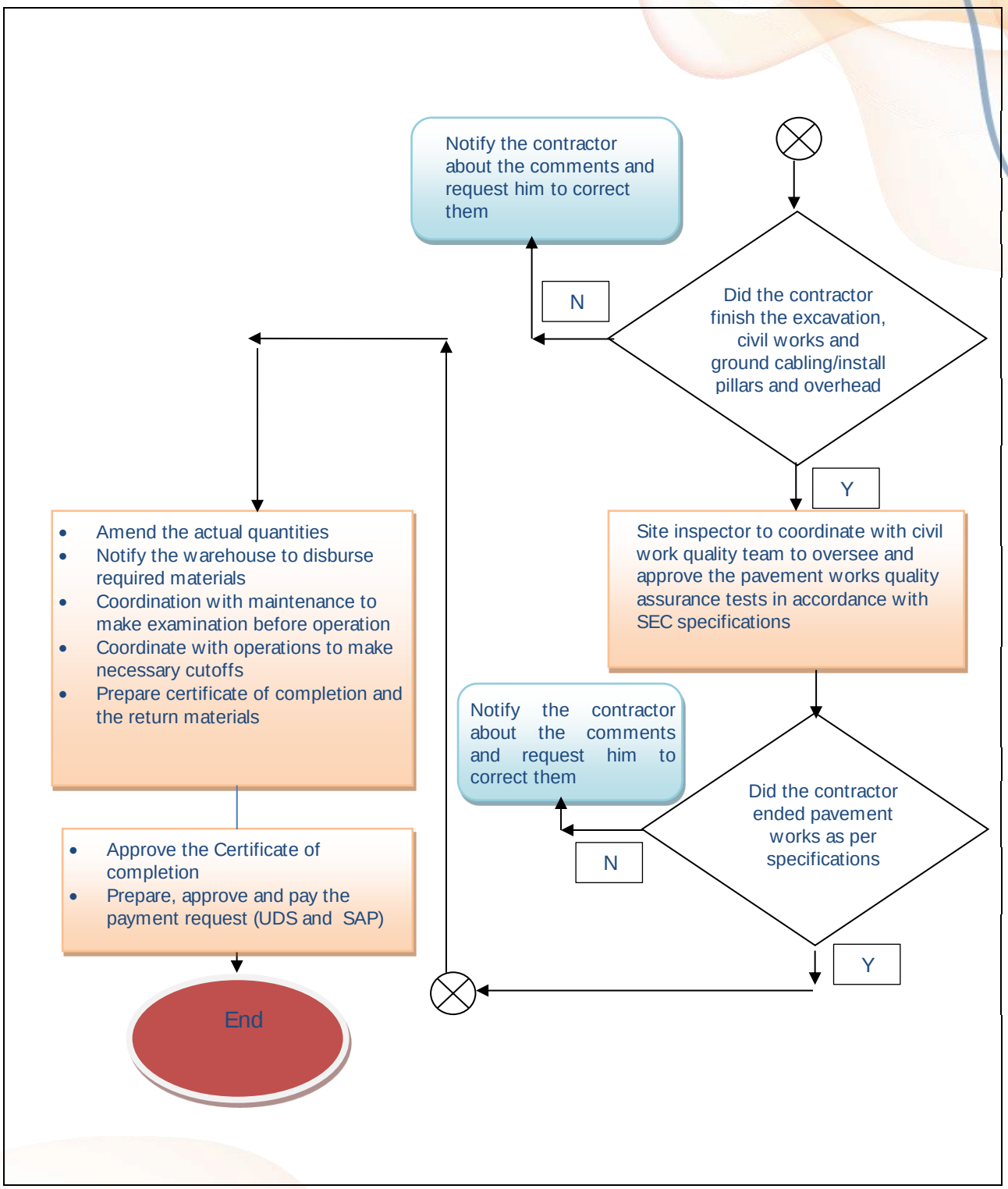

Notify the contractor about the comments and request him to correct them
N
Did the contractor finish the excavation, civil works and ground cabling/install pillars and overhead
Y
Site inspector to coordinate with civil work quality team to oversee and approve the pavement works quality assurance tests in accordance with SEC specifications
Notify the contractor about the comments and request him to correct them
N
Did the contractor ended pavement works as per specifications
Y
Amend the actual quantities
Notify the warehouse to disburse required materials
Coordination with maintenance to make examination before operation
Coordinate with operations to make necessary cutoffs
Prepare certificate of completion and the return materials
Approve the Certificate of completion
Prepare, approve and pay the payment request (UDS and SAP)
End

Figure 21: Site inspection procedure work flow

3.4.2.3. General Guidelines Of Site Inspection And Monitoring

The Inspector must visit each site where work is in progress to ensure it is completed SEC specified standard. The relevant standard documents for SEC include:

- SDCS – 01
  - Construction standards for overhead lines
- SDCS – 02
  - Construction standards for underground lines
- SDCS – 03
  - Construction standards for earthling

Detailed lists of activities which must be inspected are given in Site Inspection Guidelines. The Inspector should use the guidelines as a check to remind him of which activities he should inspect.

Each site inspector need to fill the site inspection form daily. This document can be found the appendix - Figure 29.

Compliance to the guidelines and to these procedures in general can only be ensured through Inspector commitment and with effective onsite supervision by the Foreman/Engineer. At least once per week, the Foreman/ Engineer should make unannounced site visits to each of his Inspectors. The Construction Unit Head should also make regular site visits and check the Site Inspection Card which is maintained by Contractors of any recorded problems and others.

Safety conditions onsite, adherence to design standards, completion of on-site reports, etc. should be reviewed and the Inspector accordingly advised

As a guideline Table 6 gives a summary of the most common procedures and outlines the importance of onsite presence of the supervisor or inspector.

Table 6: Overview site inspection tasks

No.	Key construction components for distribution networks	Importance of presence of Inspector / supervisor		
		Low	Medium	High
1	**Before excavation**			
1.1	Site handover card (to contractor) free of obstacles		√	
2	**Excavation**			

2.1	Supervise the excavation (work order type: ground cable/ medium voltage)		√	
2.2	Supervise the excavation (work order type: ground cable/ low voltage)		√	
2.3	Supervise the excavation (work order type: overhead network / medium voltage)		√	
2.4	Supervise the excavation (work order type: overhead network / low voltage)		√	
3	**Extend of ground cables /tighten the overhead network**			
3.1	Supervise the cable extension (work order type: ground cable/ medium voltage)			√
3.2	Supervise the cable extension (work order type: ground cable/ low voltage)			√
3.3	Supervise the pillars installation and tighten the network if the work order (overhead network / medium voltage)			√
3.4	Supervise the pillars installation and tighten the network if the work order (overhead network / low voltage)			√
3.5	Supervise the concrete casting/ build the distribution station base/ medium voltage panel/looped unit/……. / distribution board/ sub-station room..... etc.	√		
4	**Electrical fittings**			
4.1	Supervise the installation of meter		√	
4.2	Supervise the installation of sub-station/ overhead converter		√	
4.3	Supervise the inventory of ground / overhead installations			√
4.4	Supervise the grounding (distribution station, converter,		√	

	distribution board …etc.)			
4.5	Supervise the welding of connections, endings. etc.			√
5	**Quality of civil and electrical works (required the presence of engineers or consultants)**			
5.1	Supervise the backfill and tamping		√	
5.2	Supervise the soil testing and paving			√
5.3	Supervise the electrical fittings tests before operation			√
5.4	Attend the grounding tests			√
6	**Receipt of work and issuance of the certificate of completion with presence of inspector)**			
6.1	Receipt of fittings and issuance of primary/final certificate of completion (certificate of completion)			√
6.2	Receipt and register the meter details			√

3.4.2.4. Civil Work Guidelines For Typical New Connection Jobs

Typical jobs of civil works for new connections include:

Civil work for overhead

Excavations and pillars installation

- Check the type of soil (normal /rocky) during work to apply the appropriate specification
- Check the depth, diameter of the hole for the pillar and pretension (after excavation and before concrete) according to the specifications of the company
- To ensure the strait depth of pillar's hole at a 90-degree angle
- Ensure the cleanliness of the hole and not drowned with water before concrete casting, and water to be empty if any
- Ensure to place safety tape and warning signs around excavation area

Casting of pillar base

- Ensure that the concrete specifications on site are as per the technical specifications.

- Ensure that the water used in concrete casting on site is free of impurities
- The pillar to be installed in the hole before concrete casting as per specifications (as shown in Figure 22, with ensuring the existence of a steel plate
- Concrete to be casted, then the random samples to be taken for testing
- Ensure that the pillar molding is done as per the approved specifications

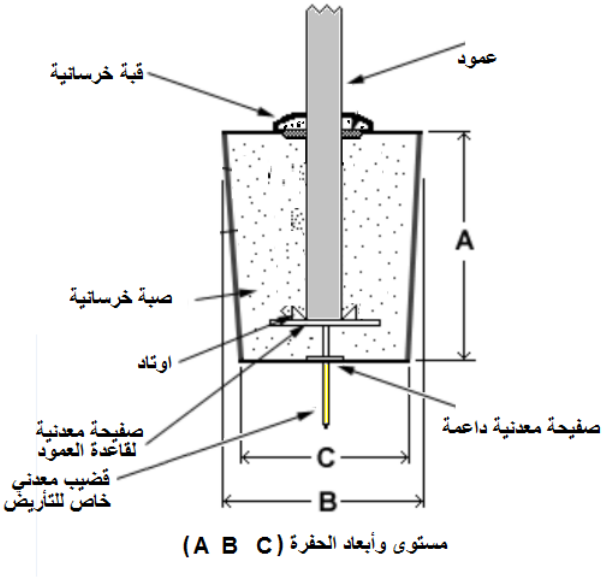


Figure 22: Illustration casting of pillar base

Backfill works

- If the whole diameter is more than the specified diameter as per specification, the hole must be backfilled after the pillar concrete base is dried within a period not less than a day.
- Ensure that the backfill materials do not contain organic materials or herbs, while contain at least 30% gravel to ensure proper mix of sand with dust.

Civil work for underground

Excavation works

- Ensure that the excavation and traffic permit, if any, had been approved by the relevant authorities and is valid
- Ensure the existence of signs at the beginning and end of excavation area and intersection, including the name of SEC and contractor, telephone and name consulting company if any.

- Ensure isolation of work site and following safety measures through warning signs and lights, metal plates for car traffic and footpaths
- Ensure that the used cable is as per the work requirements
- Get the necessary approvals from traffic department when needed
- Check the linkage areas as per the layout to ensure no barriers on the cable route
- Check the cable length and specifications, according to approved work order (taking into account the length of terminations and connections)
- Confirm to the contractor to stick to the approved timetable
- All checks must be conducted in accordance with the check-list for excavations as per Figure 31.

Excavation, backfill and cut of asphalt

- Ensure the asphalt cut with the motor driven saw
- Ensure the extension of excavation as straight as possible, without any sharp distortions protect cable from damage according to the hierarchy of services and approved layout.
- Ensure that the depth of low voltage cable hole is 65 cm, medium voltage cable 80 cm and whole width fits the number of cables as per SEC specifications.
- Ensure the position of the cable roller according to work requirements.
- Ensure using soft sand with thickness of not less than 10 cm under the low voltage cable / pipe, and 15 cm around the above the low voltage cable / pipe. (In case of medium voltage, the thickness of sand is less than 10 cm and 20 cm over and above the cable).
- Ensure that the cable hole bottom is free of rocks or sharp materials before placing sand
- In case of open excavation, the whole width must be 40 cm for a single cable and 20 cm increase for each added cable.
- In case of accurate excavation, the whole width must be 20 cm for a single cable.
- In case of accurate excavation, the cable hole must be backfilled with non-reinforced concrete as per Municipality specifications.
- If there are any facilities such as manholes etc., it must be backfilled with proper materials as per approved specifications.

Concrete casting bases of distribution stations and electric equipment

The role of construction supervisor or site inspector starts after signing the record of receipt with checking the readiness of the bases of distribution stations, equipment and subscriber transformer room.

The record of receipt includes the following with studies and planning:

1. The readiness of concrete casting bases of distribution sub-stations and equipment before being transferred to the site. Where the role of construction supervision team in the company starts after its transfer to the site as per approved layouts and specifications. This check must be conducted in alignment with the sub-station foundation check-list as per Figure 32. For mini-pillars all check must be aligned with check list as per Figure 33.
2. The readiness of subscriber substation room. Where the role of construction supervision team in the company starts after the completion room construction as per approved specifications.

Supervision on the bases of distribution sub-stations and equipment

After the readiness of the base of distribution station or equipment and acceptance by Studies and Planning function of the company and signing a record of receipt between the parties (Construction and Planning), the site inspector to supervise and inspect the distribution station or equipment in the site according to the following procedures :

- Ensure that the permit did not be changed or that the geographical layout was not amended by the municipality.
- Identify the location of the distribution station or equipment as per the layout
- The depth of the base hole should be about 80 cm with adjusting the subsoil as per specifications
- The height of base from street level should be 30 cm
- The base should be painted with coal tar, and stamp the contractor name on the concrete base
- The subunit, RMU, pillar or medium voltage measurement boards must be away at least 20 cm from the building wall
- Ensure that the location of medium voltage measurement board or distribution station …etc. are as per they approved layouts

Instructions in case of high or low level of base from ground level

- In case of ground level is higher than street level
    - The site ground base of distribution station/equipment should be adjusted as per the level of street and then digging 0.80 m. Also, the ground must be adjusted as per the street level if the height of ground surface from street level doesn't exceed 2m. But, if higher than 2 m, the ground surface to be adjusted then the base location to be dug with 0.80 m depth and show the base surface by l 0.30 m from

the ground level as shown in the following figure, and then follow the steps for completing the base as per SEC specifications. (As per Figure 23)

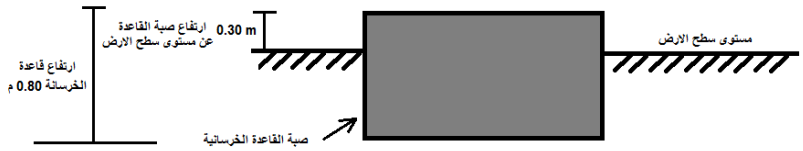


Figure 23: Illustration sub-station base - ground level is higher than street level

- If the base ground level is lower than street level by 0.80 m, the base location to be dug by 0.80 m depth, and then follow the steps for completing the base as per SEC specifications.
- If the base ground level is lower than street level by 0.80 m to 2.5 m, the following procedure should be performed:
    - Excavation down the street around 5 cm and make concrete
    - Make concrete casting as E shape above the concrete slab with height from 0.8 to 2.5 m
    - The concrete of station/equipment base to be placed over the concrete base (E) until it reaches ground surface and street level. So, the ready base to appear by 0.30 m above street level, and the completion of backfill of the concrete base as shown in the following. (As per Figure 24)
- If the ground level is lower than street level by more than 2.5 m, the responsible person to be notified; so as to take the necessary actions based on the nature of ground.

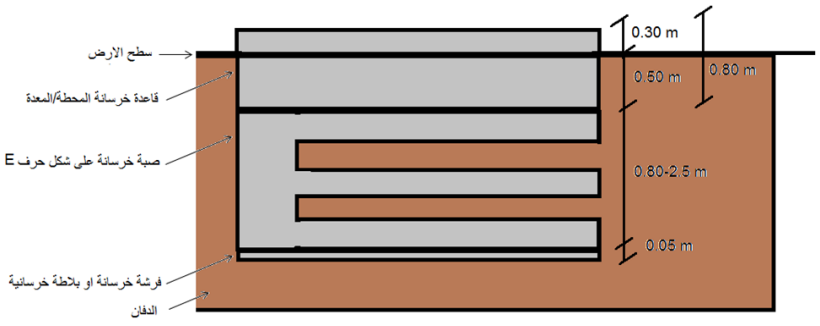


Figure 24: Illustration sub-station base - ground level is lower than street level

Procedures to check readiness of distribution sub-stations and meters rooms

After the readiness of distribution station or equipment base and approval by planning division and deliver to the construction supervising team, the site inspector has to supervise and inspect the station base or room or meters in the site according to the following procedures:

- Check that the room dimensions, height and construction are matching the company's specifications
- Ensure that the current lighting in the room is sufficient
- Cleanliness and the removal of unnecessary materials
- Easy opening and closing of doors
- Grounding steel works and installs them as per approved specifications
- Print station number and company logo on the doors
- Ensure that protection bars are installed as per approved specifications
- Closing all entrances for cables slots
- All locks are available on the required areas
- Cable holes are covered as per approved specifications
- All equipment numbers, company logo and caution signs are installed

3.4.2.5. ELECTRICAL WORK GUIDELINES FOR TYPICAL NEW CONNECTION JOBS

Typical jobs of electrical works for new connections include:

Installation of overhead transformers and accessories

The functions of site inspector to oversee the installation of overhead transformers and accessories include:

- Supervise the installation of transformer and its accessories (fuse and cut out like, arrester and transformer distribution panel) according to the specifications of the company.
- Supervise the work of electric connections required for the transformer operation as per SEC specifications.
- Supervise the work of placing grounding points for all installed equipment (transformer, fuse and cut out like, arrester and transformer distribution panel), according to the specifications.
- Supervise the connection of cables which feed the panel through the transformer and tighten clamping.

Installation of ground sub-station and accessories

The functions of site inspector of the sites to oversee the installation of the distribution stations and accessories include:

- Ensure to install the ground cable and scanned into the specifications of the company.
- To ensure of the authenticity of the connections to the malfunction indicator.
- Ensure to install the covers.
- Ensure that the installation of the meter and the safety of connections private stations.
- Ensure the safety and proper operation of voltage, amps and gas indicators.
- Ensure the safety of station's circuit breakers.
- Ensure that the station number is matching the layout with using numbering and the warning signal.
- All checks must be in line with the check lists for subs-station earthling and sub-station electrical appliances (Figure 34 & Figure 35).

Installation of ground & overhead cables and accessories

The functions of site inspector to oversee the installation of ground and overhead cables and accessories include:

- Ensure that the extension sources of cables/connectors are matching the work order, drawings and croquet (extension start and end points).
- Check the type and size of cable/connector which was extended/straining at site (overhead connector – ground cable (copper or aluminum) and match it with the work order.
- Check the circles number of cables / connectors to be extended in the routs specified in the work order.
- Check the connection points that cables / connectors will be extended to (station – overhead transformer - panel – meter box - welding point)
- Oversee the contractor while pulling and extending the cable/connector (both in ground extensions or overhead network) and ensure to use the necessary f equipment or the extension properly (wheel carrier - cable tighten tool - cable protection cover during tension – wheels (especially in the corners of cable hole)
- Ensure that the cables are arranged in cable hole and maintain the correct dimensions between cables as per the approved specifications.
- Ensure that the vertical and horizontal clearance in the overhead connectors are as per the approved specifications

3.4.3. AS-BUILT REPORT

As each section of work for equipment installation/overhead line is completed, the Inspector will record and certify all necessary detail using the As-Built Report forms. The Inspector will obtain contractor concurrence to the measurements/ quantities and will provide a copy of the report to the contractor.

As-built report form as per Figure 37 for overhead connections and for underground connection and as per Figure 36.

For cable laying work, the Inspector will record and certify cable trench and rock excavation dimensions on the As-Built Report. The Inspector will obtain contractor concurrence to the measurements and provide a copy of the report to the contractor. This will normally be done on a daily basis between equipment.

For reinstatement work the site Inspector will record and certify all necessary details and measurements on the Reinstatement As-Built Report. The Inspector will obtain contractor concurrence to the details and measurements and will provide a copy of the report to the contractor.

Note: A copy of each As-Built Report is placed in the project file.

When work is completed for each work order, the site inspector prepares As-Built Summaries for cable laying, reinstatement and overhead lines. The As-Built Summary is made by adding up the individual As-Built Reports.

A summary is not normally required for electrical equipment because one As-Built report for electrical equipment per work order is adequate.

The Site Inspector obtains the concurrence of the concerned contractor for the work quantities on the As-Built Summaries which have been prepared.

Note: The Site Inspector distributes one copy of each As-Built Summary to the concerned contractor and to the project file

3.4.4. VERIFICATION OF WORK QUANTITIES & MATERIAL BALANCE

When the contractor has submitted the Work Order with claimed quantities of work, the Site Inspector will check the claimed quantities against the As-Built Reports/Summaries. If no differences are found, he will verify by signing the Work Order in the space provided for Actual Quantities. If a difference exists, he will follow-up with the concerned contractor to submit claimed quantities in accordance with the As-Built Reports/Summaries which have already been concurred with by the contractor.

The Site Inspector will check that the major items of material - cables, electrical equipment, poles, splices and terminations - are same for Material Balance Statement as submitted by the contractor and for As- Built Reports/Summaries.

3.5. REQUEST FOR SHUTDOWN & ENERGIZATION

The procedure for requesting LV shutdown in the context of new connection projects is detailed as followed:

1. As construction work proceeds, the customer cable is connected to the meter;
2. Construction unit requests O&M Section to check the meter installation and mini-pillar (if any) as per work completion reports.
3. Construction unit requests O&M for LV Shutdown, for cable entry to distribution cabinet or mini-pillar (for U/G works only).
4. Construction unit requests O&M to check details of meter installation and sign meter information from (MIF) with all Meter particulars entered.
5. Operation and maintenance unit provides shutdown and checks work completion reports. Also checks the meter installation on SEC and customer sides.

Once the job is completed the procedure for energization starts. It comprises the below steps for new connection projects:

1. Customer relations unit informs customer to submit cleaning certificate and to pay connection charges (if not yet received).
2. On receipt of cleaning certificate and payment receipt from customer, customer relation unit sends documents to construction unit together with the account number.
3. Construction unit arranges with O&M for shutdown to make the cable connection in mini-pillar/ Distribution Cabinet for underground supply or LV Pole Connection for overhead supply. Also, installs account number plate and completes MIF.
4. O&M unit provides shutdown for cable connection to source of supply makes a final check of the meter installation before it energizes the customer power supply.

3.6. CLOSING & CONTRACTOR PAYMENT

This section outlines how closing of projects is done once all relevant documents are received and how payment of contractor is cleared.

3.6.1. CLOSING PROCEDURE

The closing of distribution projects is done in five major steps as outlined below.

1. Issuing of primary acceptance certificate via UDS. Site inspector checks work order for the below points
    a. Final implementation scheme as per 'As Built'
    b. Indication of amount of material used
        i. During the course of the work, the site inspector prepares as-built reports and obtains the concurrence of the contractor for the work quantities involved for each as-built report. As and when work is completed for each work order, the site inspector prepares as-built summaries for cable laying, reinstatement and overhead lines. A summary as-built report is not normally required for electrical equipment, because one as-built report for electrical equipment per work order' is usually adequate. The site inspector obtains the concurrence of the concerned contractor for the work quantities on the as-built summaries which have been prepared.
        ii. The site inspector distributes one copy of each as-built report and one copy of each as-built summary to the concerned contractor and to the project file.
        iii. When the work is mechanically completed, the contractor will complete the Work Order for 'Actual Quantities', 'Unit Rate SR' and 'Total Actual (SR)'. The actual quantities must agree with the as-built reports/ summaries.
        iv. Within one week of mechanical completion of service and meter jobs and mini-projects and within two weeks of mechanical completion of projects, the contractor submits Request for Verification of quantities of work and materials together with copies of as-built reports/ summaries, as-built drawing, material balance statement and all associated material documents.
        v. The site inspector checks that the claimed quantities of work corresponds with the as-built reports/ summaries If the as-built reports/summaries have already been concurred by SEC site inspector and by the contractor,

discrepancies should be rarely found in contractors submission. When any discrepancies are found, a punch list should be made and issued to the contractor for each verification file.

vi. Where the actual quantities show any deviation in the numbers of electrical equipment or a 10% deviation or more in cable trench/length (subject to a lower limit of 10 meters and an upper limit of 200 meters) a Project Amendment Sheet must be completed by Network Planning Section and forwarded to Construction Unit

vii. The time allowed for SEC to check and verify the submitted files will be two week for service and meter jobs and mini-projects and four weeks for projects.

c. Indication of work carried out

d. Examination statement carried counters (if work is included installation of counters)

e. Preparation of the primary acceptance certificate and attachment of the statement of implemented quantities (material and labor).

i. Assuring that material as well labor balance is zero i.e. all contractor tasks are closed.

2. Issuing of final acceptance certificate via UDS. After the completion of the review of documents, the inspector performs the following tasks:

a. Preparation of the final acceptance certificate which is aimed at preparing the certificate of achievement in SEC's UDS system, which tracks the date of this procedure automatically UDS system.

3. Once final approval is given, UDS will automatically send approval to contractor for review and approval from his side.

4. Technical support receives the approved work order from construction and needs to perform the below tasks

a. Review of the material balance in the system and assurance that these match the actual outline and thus the absence of residual amounts.

i. If required, network planning investigates the difference between plan and actual cost and justifies.

ii. Performs random sampling to check on-site application of material

b. Following agreement and verification, Construction Unit will certify and approve the actual quantities and will forward to finance together with invoice, payment authorization form and any associated project amendment sheets,

Material Balance Statement (MBS) and justification report (for deviation from the target completion date) if required. (UDS procedure 190 - Figure 39)

c. For customer funded cases, the customer file number/ should be shown in box for the customer file number on the Work Order copy which is sent finance.

d. Finance will check the correctness of the applied unit rate and the calculations of the total Saudi Riyals payable to the contractors.

e. Any necessary deductions will be determined by finance based on the contract and SEC procedures and the net total for payment to the contractor will be calculated.

    i. Review of other confirmed work orders in the basket and extracts included in Abstract

5. Finance proceeds immediately (if no objections from contractors) with financial closing and transfer of project expenditures to fixed asset account after approval.

3.6.2. PAYMENT AUTHORIZATION

Provided the actual quantities have been certified and approved and provided that material reconciliation is acceptable, the Work Order can be processed for payment in association with an invoice from the contractor.

According to accounts procedures, the payment authorization form must be used for all payments to contractors. One or more Work Orders may be attached to this form and the total gross sum will be the total of all associated orders before deductions. However, a separate invoice and payment authorization shall be prepared for all customer funded projects.

The payment authorization form will then be approved in accordance with SEC Corporate Approval Authority by the proponent.

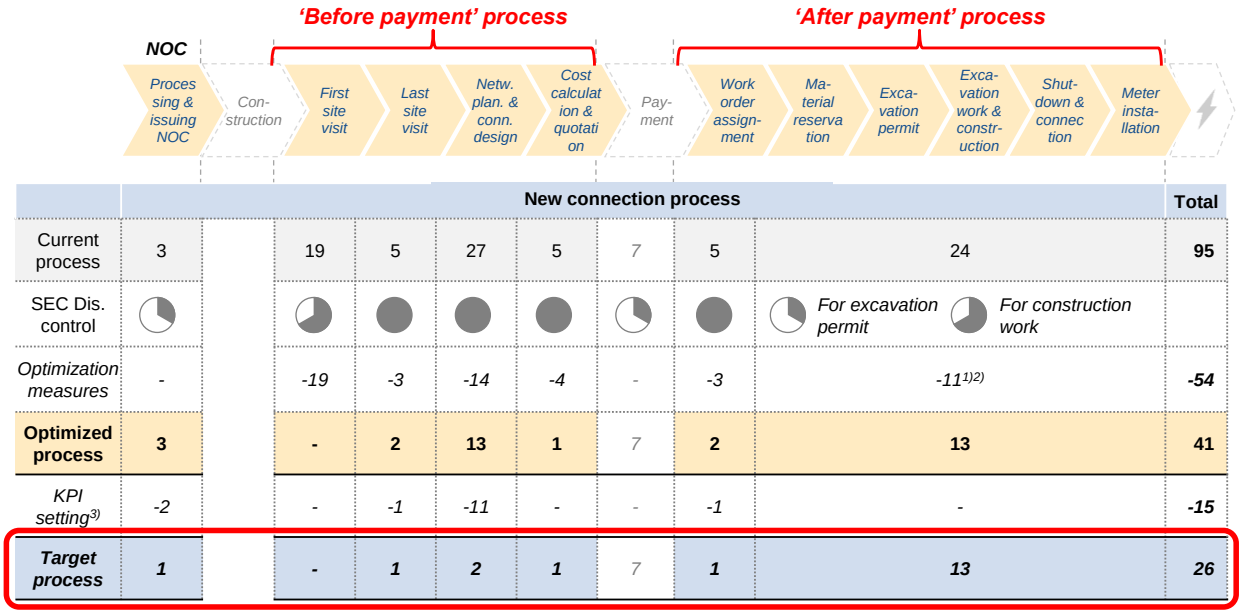
The approval by the proponent is essentially for approval of quantities of work actually carried out by the contractor. It does not include or cover checking of calculations or unit rates or deductions.

3.7. NEW CONNECTION TIME NORMS – 'AFTER PAYMENT' PROCESS

As per the outcome of the 'New Connection Process Streamlining' Project under the Sirius imitative, time norms and KPIs for each step of the before and after payment process have been defined.

Figure 25 outlines those time norms for standard connection requests within the network zone and a total requested load of below 166 kVA. Additionally, these time norms are only applicable for requests where the construction of a new sub-station is not required.

In net working days



	New connection process									Total
Current process	3		19	5	27	5	7	5	24	**95**
SEC Dis. control	◔		◕	●	●	●	◔	●	◔ *For excavation permit* ◕ *For construction work*	
Optimization measures	-		*-19*	*-3*	*-14*	*-4*	-	*-3*	*-11*[1)2)]	***-54***
Optimized process	**3**		**-**	**2**	**13**	**1**	7	**2**	**13**	**41**
KPI setting[3)]	*-2*		-	*-1*	*-11*	-	-	*-1*	-	***-15***
Target process	***1***		**-**	***1***	***2***	***1***	7	***1***	***13***	***26***

Figure 25: Time norms - after payment

The time norms for after payment activities are as per the below:

- Customer payment
  - Payment is to be received as per payment targets outlined to customers in customer service manual
- Work order assignment (WOA)
  - WOA issuing for standard connection should be done within one working day
- Construction

- All construction related activities need to be performed within a maximum of thirteen working days. These include and may run in parallel:
  - Material reservation
  - Application for excavation permit
  - Excavation and construction work
  - Shut-down and meter installation

4. APPENDIX

The appendix provides an overview of the most relevant documents related to the new connection process. The 'before payment' section provides main documents related to the network planning part of the process while the 'after payment' section includes main documents related to work order assignment, construction & inspection.

4.1. DOCUMENTS AND FORMS – 'BEFORE PAYMENT' ACTIVITIES

This section includes main documents related to the 'before payment' activities of the new connection process.

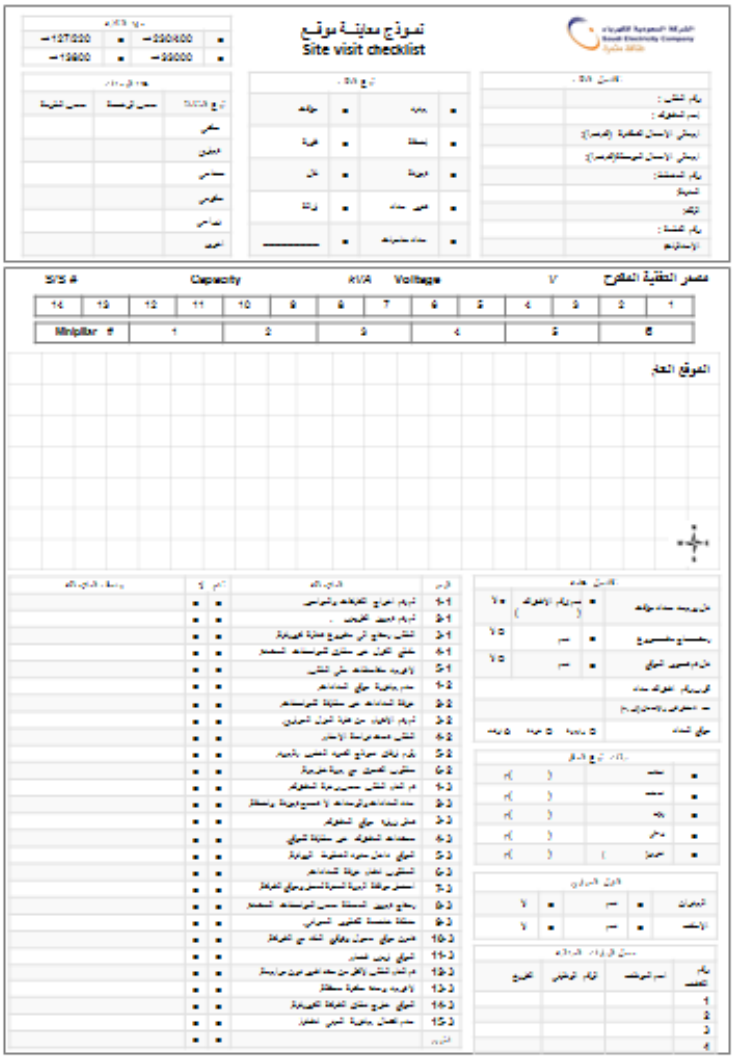
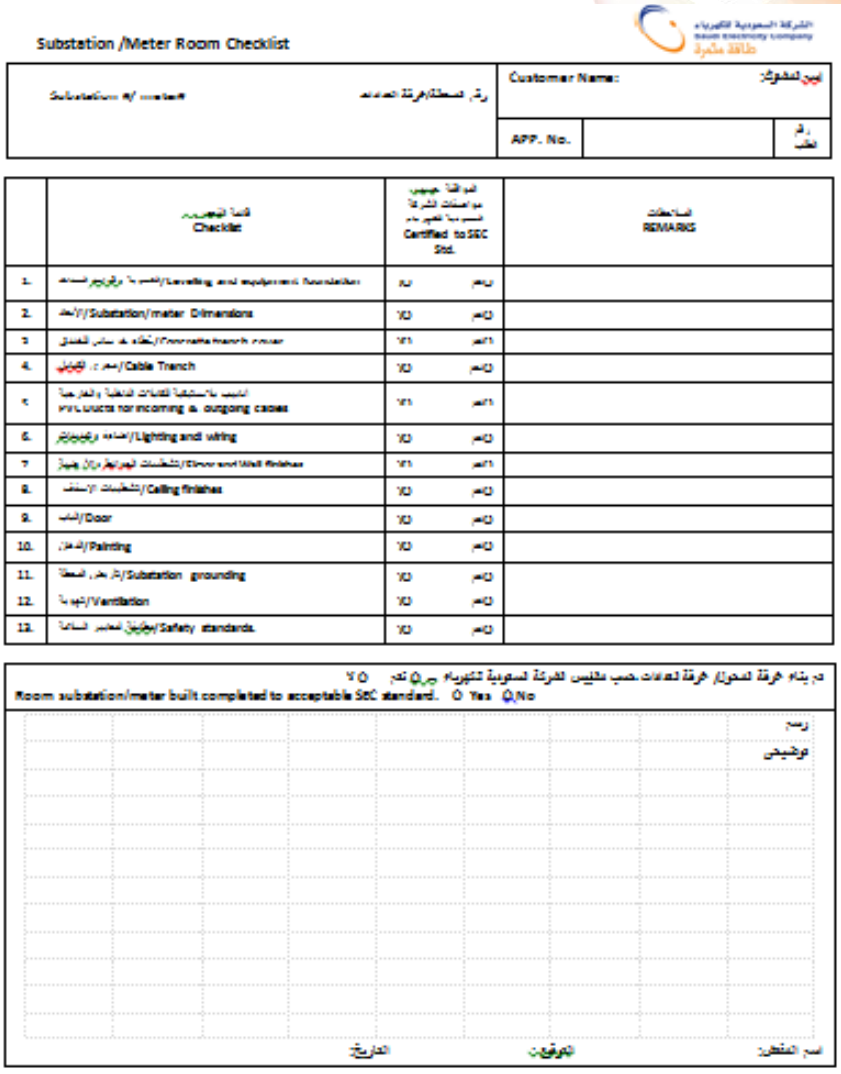


Figure 26: Site visit check list



Substation /Meter Room Checklist

Substation #/ meter# رقم المحطة/غرفة العداد	Customer Name: اسم المشترك:
	APP. No. رقم الطلب

	Checklist قائمة التحقق	Certified to SEC Std. مطابق لمواصفات الشركة السعودية للكهرباء	REMARKS الملاحظات
1.	تسوية وقواعد المعدات/Levelling and equipment foundation	نعم O لا	
2.	أبعاد المحطة/غرفة العداد/Substation/meter Dimensions	نعم O لا	
3.	خندق من الخرسانة/Concrete trench cover	نعم O لا	
4.	مجرى الكابلات/Cable Trench	نعم O لا	
5.	أنابيب للكابلات الداخلة والخارجة/Pipes/ducts for incoming & outgoing cables	نعم O لا	
6.	الإضاءة والتوصيلات/Lighting and wiring	نعم O لا	
7.	مقابس التيار الكهربائي/Electrical Wall Sockets	نعم O لا	
8.	تشطيبات الأسقف/Ceiling finishes	نعم O لا	
9.	الباب/Door	نعم O لا	
10.	الدهان/Painting	نعم O لا	
11.	تأريض المحطة/Substation grounding	نعم O لا	
12.	التهوية/Ventilation	نعم O لا	
13.	معايير السلامة/Safety standards.	نعم O لا	

تم بناء غرفة المحول/ غرفة العدادات حسب مقاييس الشركة السعودية للكهرباء نعم O لا
Room substation/meter built completed to acceptable SEC standard. O Yes O No

رسم توضيحي

اسم المفتش: التوقيع: التاريخ:

Figure 27: Substation site visit check list

4.2. DOCUMENTS AND FORMS – 'AFTER PAYMENT' ACTIVITIES

This section includes main documents related to the 'after payment' activities of the new connection process.

Div.....:دائرة	برنامج العمل اليومي للمقاول DAILY REPORT FOR CONTRCTOR	Dep.....:ادارة كهرباء

تمديد كابلات ض.ع. / ض. م.	1	Cable laying L V / H V	CONTRACTOR: المقاول:
توصيلات ض. ع. / ض. م.	2	Jointing termination L V / H V	
اعمال داخل المحطة	3	Inside S/S work	
صب خرسانة	4	Concreting	م.المقاول: CONT.ENG:
تركيب معدات	5	Equipment installation	
زيارة موقع أمر العمل	6	New scheme site visiting	الجوال والتوقيع: Sign &Mobil:
حفريات واعمال اخري	7	Excavation and other work	

DATE: التاريخ :	اليوم : DAY:

وصف العمل Jop Descreption	رمز العمل Jop code	الوقت Time	اسم المفتش Inspecter Name	طول الحفر Exca. Length	رقم المحطة S/S NO.	الموقع Location	رقم أمر العمل W/O NO.	اسم المشترك/ المشتركين Consumer. Name	الرقم No.
									1
									2
									3
									4
									5
									6
									7
									8
									9
									10
									11
									12
									13

FORM-SEC-02

Figure 28: Daily report for contractor

الشركة السعودية للكهرباء
Saudi Electricity Company
طاقة مثمرة

دائرة:.....Div	برنامج العمل اليومي للمفتشين INSPECTOR DAILY REPORT FOR SITE	ادارة كهرباء:.....Dep

DAY :	اليوم:	قسم: □المشاريع □ توصيلات المشتركين
DATE :	التاريخ : / / 200 م	SECTION: PROJECTS □ CUSTOMERS CON.□

1	Cable laying L V / H V	تمديد كابلات ض.ع. / ض. م.
2	Jointing termination L V / H V	توصيلات ض. ع. / ض. م.
3	Inside S/S work	اعمال داخل المحطة
4	Concreting	صب خرسانة
5	Equipment installation	تركيب معدات
6	New scheme site visiting	زيارة موقع أمر العمل
7	Excavation and other work	حفريات واعمال اخري

فترة التواجد ATTEND. PERIOD	المفتش INSPECTOR	نوع العمل WORK TYPE	المقاول CONTRACTOR	رقم المحطة SUB. NO.	الموقع LOCATION	رقم أمر العمل WORK ORDER NO.	م
							1
							2
							3
							4
							5
							6
							7
							8
							9
							10
							11
							12
							13
							14
							15
							16
							17

Signature: التوقيع:	AUTHORIZED ENG: المهندس المختص:

FORM-SEC-03

Figure 29: Inspector daily report for site

اسم المقاول: CONTRACTOR:	برنامج المقاول الأسـبوعي CONTRACTOR WEEKLY PROGRAM	ادارة كهرباء: Dep.....
مهندس المقاول: ENG . CONT:	من تاريخ (From date): / / الى تاريخ (To date) : / /	دائرة Div.....

المسلسل	رقم أمر العمل	اسم المشترك / المشتركين	تاريخ مقترح لبدء العمل	برنامج العمل اليومى DAILY WORK PROG.					الموقع	رقم المحطة	تاريخ التسليم للمقاول	الجهد	الطول	المنجز			
	ORDER NO WORK	CUSTOMER NAME		SUN الاحد	MON الاثنين	TUS الثلاثاء	WEN الاربعاء	THU الخميس	LOCATION	SUB. NO	RECEIVE DATE	VOLTAGE	LENGTH	رخصة الحفر	ورقة القياس	الاسفلت	ش الانجاز

1. تمديد كابلات ج.ع. / ج. م (Cable laying L V / H V)
2. توصيلات ج. ع. / ج. م (Jointing termination L V / H V)
3. اعمال داخل المحطة (Inside S/S work)
4. صب خرسانة (Concreting)
5. تركيب معدات (Equipment installation)
6. زيارة موقع أمر العمل (New scheme site visiting)
7. حفريات واعمال اخري (Excavation and other work)

ممثل الشركة (COMPANY REP.)

ممثل المقاول (CONTRACTOR REP.)

FORM-SEC-04

Figure 30: Contractor weekly program

الشركة السعودية للكهرباء
Saudi Electricity Company
طاقة مثمرة

Div.....دائرة	أعمال الحفر وتمديدات الكوابل Excavation & Cable Laying Work	Dep.....ادارة كهرباء

Feeder No.: رقم المغذي:	Location: الموقع:
Work Order No.: رقم أمر العمل:	Contractor المقاول

S.#	DESCRIPTION	لا/نعم YES/No	البيان	رقم
1.	Is trench as per municipality map of "Right of Way"?		هل الحفريات تقع في حدود المسار المحدد للكابل من الشارع حسب مخطط البلدية؟	1
2.	Has excavation area been property barricaded and caution sign posted?		هل منطقة الحفر محاطة بالحواجز اللازمة وإشارات التحذير مبينة جداً؟	2
3.	Is Contractor Signboard with municipality map available at site?		هل يوجد لوحة عليها شعار الشركة و أسم المقاول وصورة من تصريح الحفر؟	3
4.	Are traffic and pedestrian movement provisions placed?		هل وضعت معابر مرور للسيارات والمشاة حسب المواصفات ؟	4
5.	Is a trance dimensions as per specifications?		هل أبعاد الحفر حسب مواصفات الشركة؟	5
6.	Is excavated material removed from site before cable laying?		هل تم إزالة مخلفات الحفر قبل تمديد الكوابل ؟	6
7.	Are enough manpower available?		هل هناك عدد كافي من العمالة عند التمديد؟	7
8.	Has damage been caused to any of the existing utilities? If yes has the relevant authority notified?		هل حدث ضرر لأي من الخدمات الموجودة ؟ إذا نعم ؟ هل تم الاتصال بالجهة المعنية؟	8
9.	Is subsoil water being removed?		هل تم سحب المياه من الحفرية؟	9
10.	Are pipe laid as per specifications and ends capped properly?		هل نفذت المواسير حسب مواصفات الشركة وتم تغطية الفتحات جيدا ؟	10
11.	Is sand placed on top and bottom of cable?		هل وضع الرمل المناسب حسب مواصفات الشركة أسفل وأعلى الكوابل؟	11
12.	Are cable-end seals in good condition (cover the end of cable) ?		هل موانع التسرب على أطراف الكوابل في حالة جيدة (غطاء نهاية الكابل) ؟	12
13	Have sufficient and appropriate cable roller been provided and property positioned?		هل وضعت عجلات سحب الكوابل المناسبة بإعداد كافية جيداً ؟	13
14	Was any defect/damage noticed on cable, while lying?		هل لوحظ أي تلف / عيب في الكابل أثناء تمديده؟	14
15.	Have the cables been laid in proper configuration & tight every 3-mts.		هل وضعت الكوابل على تفريقات مناسبة على الحوامل وربطت كل 3 أمتار ؟	15
16	Is cable straightened after removed of rollers?		هل الكابل مستقيم بالحفرية بعد إزالة عجلات السحب؟	16
17	Are cables laid with proper spacing in between according SEC standards ?		هل تم ترك خلوص كافي بين الكوابل حسب المواصفات؟	17
18	Has clearance been maintained from other utilities as per standard?		هل ترك خلوص كافي بين الخدمات الأخرى حسب المواصفات ؟	18
19	Have the newly cut cable-end been properly sealed (cover the end of cable) ?		هل ختم طرف الكيبل المقطوع حديثاً (غطاء نهاية الكابل) ؟	19
20	Is warning tape laid		هل تم وضع شريط التحذير؟	20
21	Is trench backfilled		هل تم دفان الحفرية؟	21
22	If the drilling is an exact drill, is the concrete is done ?		اذا كان نوع الحفر حفر دقيق (هل تم صب الخرسانة)؟	22
23	Is trench asphalted		هل تم سفلتة الحفرية؟	23
24	If the drilling is an exact drill, is the asphalt is scraped and returned?		في حالة الحفر الدقيق (هل تم كشط الاسفلت واعادته)؟	24
25	Have you been back to work to what it was ?		هل تم اعادة الوضع الى ماكان عليه ؟	25

ملاحظة (Remark) :
اذا كان احد الملاحظات اعلاه ملاحظة جوهرية ، فيجب على مفتش المواقع ابلاغ مشرف الانشاءات لمخاطبة المقاول وايقاف امر العمل لحين اصلاح الملاحظة.

اسم مفتش الموقع (Site Inspector) :..... ، التوقيع / التاريخ (Signature& Date):.....

FORM-SEC-05

Figure 31: Check list - excavation & cable laying work

قواعد المحطات
Substation Foundation

Div.	دائرة:	Dep.	ادارة كهرباء:
Order No.	رقم امر العمل:	Location:	الموقع:
Feeder No.	رقم المغذي:	Contractor:	المقاول:

S.No.	DESCRIPTION	لا NO	نعم YES	البيان	الرقم
1.	Is package unit location demarcation done by SEC and contractor surveyor?			هل تم تحديد موقع القاعدة حسب المخطط؟	.1
2.	In case of unavailability of profile please make sure of following:			في حال عدم وجود مناسيب التأكد من التالي:	.2
2.1	Is excavation depth 80 cm?			هل تم التأكد من أن الحفر على عمق 80 سم؟	2.1
2.2	Is excavated place leveled?			هل تم تسوية باطن الحفرية؟	2.2
2.3	Is shuttering as per specification so as the level of foundation to be 30 cm more than municipality proposed level?			هل تم تركيب البرواز حسب المواصفات بحيث يكون ارتفاع القاعدة عن مستوى الشارع المقترح من الأمانة بـ30سم؟	2.3
2.4	Is the foundation done as per SEC specification?			هل تم عمل القاعدة حسب مواصفات الشركة ؟	2.4
2.5	Is black bitumen paint for waterproofing applied?			هل تم طلاء الصبة بمادة القطران الفحمي؟	2.5
2.6	Is contractor name engraved?			هل تم ختم أسم المقاول على القاعدة الأسمنتية؟	2.6

Remarks (if any): ملاحظات (إذا وجدت):

اسم مفتش المواقع (Inspector Name):

التوقيع (Sign) :

FORM-SEC-06

Figure 32: Check list - substation foundation

لوحة التوزيع MINIPILLAR					
Div.	دائرة:		Dep.	ادارة كهرباء:	
Location:	الموقع:		Order No.	رقم امر العمل:	
Contractor:	المقاول:		Feeder No.	رقم المغذي:	
S.No.	DESCRIPTION	نعم YES	لا NO	الوصف	الرقم
1	Is foundation installed correctly?			هل تم تثبيت قاعدة لوحة التوزيع بطريقة صحيحة؟	1
2	Location of MP foundation:			موقع قاعدة لوحة التوزيع:	2
2.1	20cm away from bldg. boundary wall?			20 سم من حد حائط المبنى؟	2.1
2.2	According to project drawing?			حسب مخطط أمر العمل؟	2.2
3	Is MP door and locks OK?			هل باب لوحة التوزيع يعمل بصورة جيدة؟	3
4	All four bolts are properly fixed and tightened?			جميع البراغي مثبتة ومربوطة بأحكام؟	4
5	No damage to MP body and painting?			لا يوجد عطب في جسم لوحة التوزيع أو الدهان؟	5
6	Grounding of MP as per SEC standard?			هل التأريض حسب مواصفات الشركة؟	6
7	Termination of cable inside MP with proper connection?			هل توصيلات الكابل داخل لوحة التوزيع ربطت جيداً؟	7
8	Connections checked for tightness?			هل فحص شد التوصيلات؟	8
9	Color sequence inside MP checked			هل فحص تتابع الألوان داخل لوحة التوزيع ؟	9
10	MP number and Monogram and danger signs is stenciled?			هل رقم لوحة التوزيع والشعار ولوحة الخطر مبين؟	10
11	Circuit numbers are stenciled?			هل أرقام الدوائر مبينة؟	11
12	Site cleared and reinstatement done?			هل الموقع نظيف والوضع معاد إلى ما كان عليه ؟	12

Remarks (if any): ملاحظات (إذا وجدت):

اسم مفتش المواقع (Inspector Name):

التوقيع (Sign) :

FORM-SEC-07

Figure 33: Check list - mini-pillar

تأريض المحطات Substation Earthing					
ادارة كهرباء (Dep):			دائرة (Div):		
Location: الموقع:			Project No.: رقم المشروع:		
Contractor: المقاول:			Work Order No.: رقم أمر العمل:		
الرقم	البيان	لا NO	نعم YES	DESCRIPTION	S.No.
1.	هل رأس قضيب التأريض على عمق 50 سم من سطح الأرض حسب مواصفات الشركة ؟			Is Earthing Rod depth 50 cm from ground level according to SEC standard?	1.
2.	هل تم غرس قضيب التأريض بشكل جيد؟			Is Earth Rod properly drive?	2.
3.	هل تم توصيل قضبان التأريض بسلك التأريض الرئيسي الموصل بالمعدة؟			Is Earth Rods interconnected properly?	3.
4.	هل تم غرس العدد الكافي من قضبان التأريض ؟			Is Compaction around earth plate done properly?	4.
5.	هل قياس مقاومة الأرضي لا تتجاوز إلـ(5) أوم حسب مواصفات الشركة؟ (التأكد من أن الحفرية لم تغمر بالماء عند القياس)			Is Earthing value as per SEC standard (Less than 5 OHM)? (No water insert during the measurement)	5.
6.	هل تم التأكد من أن سلك التأريض الرئيسي غير مجروح أو به وصلات؟			Is Main Earthing Cable checked without any damage and without connector?	6.
7.	هل تم توصيل جميع المعدات والأبواب على التوازي بسلك التأريض الرئيسي؟			Are all equipment and doors interconnected with earthing?	7.

Remarks (if any): ملاحظات (إذا وجدت):

اسم مفتش المواقع (Inspector Name):

التوقيع (Sign) :

FORM-SEC-UG-08

Figure 34: Check list - substation earthing

فحص محطة التوزيع الفرعية والمعدات الكهربائية (Substation and Electrical Equipment inspection)					
دائرة (Div):				ادارة كهرباء (Dep):	
S.No.	DESCRIPTION	نعم YES	لا NO	الوصف	الرقم
1.0 Substation Room:				**1.0 غرفة المحطة**	
1.1	Is S/S Lighting installation satisfactory?			هل الإنارة الموجودة بالمحطة كافية؟	1.1
1.2	Is S/S clean & clear of excess materials?			هل المحطة نظيفة والمواد الزائدة مزالة؟	2.1
1.3	Do all doors open & close without difficulty?			هل جميع الأبواب تفتح وتغلق بدون صعوبة؟	3.1
1.4	Are all metal works grounded as in standard ?			هل جميع أعمال الحديد مؤرضة ومثبتة حسب المواصفات ؟	4.1
1.5	Is company monogram & Substation number printed on door?			هل تم طبع رقم المحطة وشعار الشركة على الأبواب؟	5.1
1.6	Are guard barriers fitted per drawings?			هل عوارض الحماية مركبة حسب الرسومات؟	6.1
1.7	Is all cable entry holes (HV & LV) sealed?			هل جميع مداخل فتحات الكوابل (ج.م /ض.ع) مغلقة؟	7.1
1.8	Are Padlocks fitted at all designated points?			هل الأقفال مركبة على جميع الأماكن المطلوبة؟	8.1
1.9	Are all cable trenches covered as in standard?			هل خنادق الكوابل مغطاة حسب المواصفات؟	9.1
1.10	Are all equipment numbers monograms and danger plates installed?			هل جميع أرقام المعدات وشعار الشركة ولوحات الخطر مثبتة ؟	10.1
2.0 HV-RUM Switchgear :				**2.0 مفاتيح معدات الجهد العالي:**	
2.1	Is RMU/Switch fixed level and security?			هل المفتاح مثبت جيداً ومتوازن ؟	1.2
2.2	Are Gas correct?			هل مستوى الغاز صحيح ؟	2.2
2.3	Is it free from leaks?			هل المفتاح خالي من أي تسرب ؟	3.2
2.5	Are HV Switches numbered?			هل مفاتيح ج.ع مرقمة ؟	5.2
2.6	Are HV Switch labeling accord to other S/S?			هل أرقام مفاتيح ض.ع متوافقة مع المحطات الأخرى ؟	6.2
2.8	Is mechanical operation correct?			هل العملية الميكانيكية صحيحة ؟	8.2
2.9	Is foundation damaged / cracked?			هل القاعدة تالفة أو مكسورة ؟	9.2
3.0 Transformers (package, subunit) :				**3.0 المحول والمحطات الفرعية :**	
3.1	Is Oil level correct & no oil leak?			هل مستوى الزيت صحيح وهل يوجد تسرب في الزيت ؟	1.3
3.2	Is LV neutral grounding as in standard?			هل تأريض محايد ض.م حسب المواصفات ؟	2.3
3.3	Does T/F primary & secondary voltage match SEC voltage Standard?			هل جهد المحول الابتدائي والثانوي متماثل مع مواصفات الجهد للشركة ؟	3.3
3.4	Does temperature gauge been checked?			هل تم فحص معيار الحرارة ؟	4.3
3.5	Is foundation not damaged?			هل القاعدة سليمة ؟	5.3
4.0 LV Panel:				**4.0 لوحة الجهد المنخفض :**	
4.1	Is panel installed level and securely?			هل اللوحة ثابتة ومتوازنة ؟	1.4
4.2	Are the LV cable correctly terminated?			هل أطراف كوابل ض. م موصلة بصورة صحيحة ؟	2.4
4.3	Are circuit numbers displayed correctly?			هل أرقام الدوائر مبينة بصورة صحيحة ؟	3.4
4.4	Are danger plates/monograms mounted?			هل لوحات الخطر / شعار الشركة مثبته ؟	4.4
4.5	Are level circuits fused correctly?			هل قواطع الدوائر صحيحة ؟	5.4
4.6	Is LV neutral grounding as per?			هل محايد اللوحة مؤرض حسب المواصفات ؟	6.4
4.7	Is foundation good?			هل القاعدة سليمة ؟	7.4
5.0 Earth – Fault Indicator :				**5.0 مؤشر العطل الأرضي :**	
5.1	Is E.F.I correctly installed?			هل مؤشر العطل الأرضي مثبت بصورة صحيحة ؟	5.1
5.2	Is E.F. I tested?			هل تم فحص مؤشر العطل الأرضي ؟	5.2
FORM-SEC-UG-09				اسم المفتش وتوقيعة (inspector name & Sign)	

Figure 35: Check list - substation electrical

OPERATING AREA
ELECTRICITY DEPT.
ELECTRICITY OFFICE

منطقة أعمال
إدارة كهرباء
مكتب خدمات

الشركة السعودية للكهرباء
Saudi Electricity Company

نموذج اجراء 155

ورقة القياس
MEASUREMENT SHEET

SHUT DOWN DATE:	تأريخ التطفئة:
CONTRACTOR:	المقاول:
LOCATION:	الحي:
SCHEME NO.:	رقم أمر العمل:

C. SURV:	مساح المقاول:
C. ENG:	مهندس المقاول:
SEC SUPV:	مفتش الشركة:
SEC ENG:	مهندس الشركة:

من نقطة ... الى نقطة...	From point...to point...	نوعية الذرية	الحفريات EXCAVATION: SOIL CLASS.	LENGTH الطول	WIDTH العرض	DEPTH العمق	الاسفلت ASPHALT: LENGTH الطول	WIDTH العرض	بلاط ارضيات TILES: LENGTH الطول	WIDTH العرض	شدود مواسير	R.C. PIPE	وصلات فرع أنبوبي HV /LV JOINTS	تمديد الكابل CABLE LAYING: مقاس الكابلات SIZE OF CABLE	طول الكابل بالخطوة L. IN TRENCH	الطول داخل الموصلة THRU JOINTS	طول الكابل الظاهر LOOP	الطول الكلي للكابل TOTAL	الكشف والتشديد EXPOSE & RELAY	شرط التحذير MARKER TAPE	النهايات TERMINATION	نهايات معزولة INSULATED E/C	قضيب تأريض EARTH ROD	ملاحظات وتركيبات واعمال أخرى CONS.&OTHER, WORKS

SMC	DMC	CT.C	4MC	FRAM	....CB	....CB	....CB	....CB	....CB	S/S	P/U	LVDP	TF#	TF CAP	RMU	O/S	F/S	M.UNIT	Brea.TER	TILES
B/LINK	B/CAP	STEEL PIPE		GARD POST	F/S PLI.		PU PLI.		MINIPILL	1X .... WIRE			1X .... WIRE		EFI	EARTH PLATE		PVC PIPE W/O CON.		

REMOVED MATERIALS : مواد مخلوعة من الشبكه :

THER MATERIAL & REMARKS : مواد أخرى أو ملاحظات :

SEC-FORM-28

مفتاح لرموز / SYMBOL KEY

SMC	SINGL METER BOX	صندوق عداد مفرد
DMC	DOUBLE METER BOX	صندوق عداد مزدوج
CT.C	CURRENT TRANSFORMER CABINET	صندوق عداد بمحولات تيار
4MC	FOUR METER CABINET	صندوق لأربعة عدادات
FRAM	SIX METERS STEEL FRAME	بروواز حديدي لستة عدادات
CB	CIRCUIT BREAKER	قاطع
S/S	ROOM SUBSTATION	محطة بغرفة
P/U	PACKAGE UNIT	محطة معلبة
LVDP	LV DISTRIBUTION PANEL	لوحة توزيع
TF	TRANSFORMER	محول
TF CAP	TRANSFORMER CAPACITY	سعة المحول
RMU	RING MAIN UNIT	وحدة حلقات
O/S	OIL SWITCH	مفتاح زيتي قابل للتوسعة (حلقي)
F/S	FUSE SWICH	مفتاح فيوز(حلقي)
M.UNIT	METERING UNIT	وحدة قياس حلقية
BREA.TER	BREAKING TERMINATION	إزالة نهاية
TILES	TILES	بلاط
B/LINK	BUSBAR LINK	وصلة قضيب التوصيل
B/CAP	BUSBAR CAP	غطاء قضيب التوصيل
F/S PLI	OIL SWITCH FOUNDATION	قاعدة مفتاح فيوز حلقي
P/U PLI	PACKAGE UNIT FOUNDATION	قاعدة محطة معلبة
EFI	EARTH FAULT INDICATOR	مؤشر الأعطال الأرضية

Figure 36: As-built report UG

ادارة كهرباء: Dep.	تقرير ملخص تنفيذ الخط الهوائي OVERHEAD LINE AS-BUILT REPORT / SUMMARY	دائرة: Div.
رقم امر العمل: Order No.	اسم الموقع: Location name:	اسم المقاول: Contractor name:
		حسب النموذج التفصيلي: من الصفحة ( ) الى الصفحة ( )

التسلسل	نوع التركيب		العدد/الكمية	المجموع	ينطبق	لا ينطبق
1	لوحة التوزيع ض.م (وحدة) LV-DIS BOX (EACH)					
2	محول ك.ف.ا (الكمية/السعة) Transfor.In KVA (Qty/Size)					
3	قاطع تيار (وحدة) Fuse Cutout (EACH)					
4	موصل Conductor	كابل مجدول (بحر) Quadrup. Cable (Span)				
		حيادي (بحر) Neutral(Span)				
		طور (بحر) Phase (Span)				
5	قضيب شد مع المثبت (وحدة) Guy w/ Anchor (EACH)					
6	أبعاد العمود Pole Configuration	عامود زاوية عمودية (وحدة) Angle (90) Pole (EACH)				
		عامود زاوية/نهاية (وحدة) Angle Pole (EACH)				
		عامود وسطي (وحدة) Inter Mediate Pole (EACH)				
7	التأريض Earthing					
8	عمود Pole (وحدة) (EACH)	أعلى من15 م Above 15 M				
		حتى 14 م Up to14 M				
9	قطاع العامود Section Pole					

اسم مفتش المواقع و توقيعة (Name inspector and Sign):

SEC-FORM-OH-12

Figure 37: As-built report OH

نموذج تركيب عداد عادي / عداد محول تيار

تركيب العداد (ج م) □ عداد ميكانيكي او الكتروني □ عداد محول تيار

L V METER INSTALLATION □ M/E METER □ CT METER

ادارة كهرباء (Dep):	**دائرة (Div) :**
الموقع:	**رقم أمر العمل:** **Work Order No.**
المقاول:	

S.No.	DESCRIPTION	نعم YES	لا NO	الوصف	الرقم
1.	Meter/CT meter boxes are leveled at correct height and installed securely.			صندوق العداد / محولات التيار مثبتة بإحكام وعلى علو صحيح ومتوازن.	1
2.	Ground rod installed & connected to meter box/ CT box as per standard.			قضيب التأريض مثبت وموصل بصندوق العداد حسب المواصفات.	2
3.	Customer ground wires are bonded with neutral.			سلك تأريض المشترك موصل بالمحايد.	3
4.	All cables and internal wiring of meter boxes/CT boxes are connected tightly.			جميع الكوابل / التوصيلات قد فحصت للتأكد من صحة التوصيل.	4
5.	Plates for customer number / flat shop Nos/source of supply & CT meter tags are installed.			لوحة رقم الاشتراك و مصدر التغذية ومحول التيار ركبت.	5
6.	Temporary KWH meter is removed.			العداد المؤقت أزيل (إن وجد).	6
7.	Phase rotation of SEC incomer is checked.			تم فحص صحة دوران قرص العداد .	7
8.	M/F is completed			هل تم تدوين معلومات العداد من الموقع .	8
9.	CT polarity and secondary wiring continuity are checked.			قطبية محول التيار والاستمرارية فحصت.	9

ملاحظة : التركيبات احكمت واغلقت حسب مواصفات الشركة
اسم المفتش:
التوقيع:

Comments: The installation has been sealed and locked as per Standard.
Inspector name :
Sign;

SEC-Form-M-16

Figure 38: Check list - meter installation

الشركة السعودية للكهرباء Saudi Electricity Company		
دليل إيضاح إجراءات إيصال الخدمة الكهربائية في نظام التوزيع الموحد (UDS)	DATE: 07 June 2016	Page 16 of 19

الشركة السعودية للكهرباء / إدارة كهرباء .....
مكتب خدمات .....

نموذج إجراء رقم (190)

إنتهاء التركيبات وإيصال الكهرباء لقاطع العداد

رقم الطلب:		الموقع:	
اسم المقاول:		رقم مصدر التغذية:	

البيان	نعم	لا	ملاحظات
1- سلامة التوصيلات الكهربائية وسلامة العداد والصندوق.			
2- مناسبة ارتفاع العداد ويكون في وضع متوازن وغير مائل.			
3- وجود رقم عداد على الصندوق (باستخدام جهاز الترقيم).			
4- التأكد من توصيلات العداد (مباشر – محول التيار .C.T).			
5- تختيم العداد والصندوق.			
6- مطابقة سعة قاطع العداد مع السعة المعتمدة.			
7- مطابقة بيانات امر العمل على الطبيعة والتأكد من انتهاء كامل أعمال التركيبات الكهربائية ووصول الكهرباء لقاطع عداد المشترك.			

تنويه : في حالة ان البيان اعلاه لا يشمل "لا" فهذا يعني الانتهاء من كامل أعمال التركيبات الكهربائية بما فيها تركيب العداد ويمكن استفادة المشترك من الخدمة الكهربائية بعد تسليمه لشهادة إتمام البناء "شهادة النظافة " أو محضر إنذلاق الخدمة الكهربائية للمرافق الحكومية والشركات طبقاً لدليل خدمات المشتركين.

وعلى ذلك جرى التوقيع أدناه

مندوب المقاول					
الاسم:		التوقيع:		التاريخ:	

ممثل الشركة السعودية للكهرباء			
الاسم:		الرقم الوظيفي:	
التوقيع:		التاريخ:	

Figure 39: UDS Procedure 190 Form

Figure 40: UDS Procedure 200 Form